the OIL AND GAS JOURNAL

PUBLISHED WEEKLY SEPTEMBER 7, 1959

The outlook in both the United States and Europe, plus first world-wide survey of plants features this 1959 . . .

Petrochemical Report

p.121

Also in this issue . . .

Steel strike isn't pinching oil men yet ▸ 93

Jersey to merge Humble, Carter, Esso Standard ▸ 96

Big power packages for compressor stations ▸ 177

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OIL AND GAS JOURNAL
Vol. 57 No. 37

Contents September 7, 1959

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ANNUAL PETROCHEMICAL REPORT

U. S. Petrochemicals Reach New Peak 121

By Dr. R. L. Bateman

Production for 1959 should total 48.8 billion pounds, an increase of 15.5% over 1958. By 1965 the demand for petrochemicals will grow to 85 billion pounds with value in excess of 10 billion dollars. Present product uses will expand; there will be entirely new resins, fibers, synthetic fuels, and lubricants.

Europe's Petrochemical Industry Growing Rapidly 123

By Howard A. Kirsch and Dr. W. E. Kuhn

Europe's refinery throughput has grown steadily over the last 11 or 12 years. Result is that these refining operations have made available raw materials which have encouraged growth of European petrochemicals. Petrochemical production from the five major free European countries has grown from about 208,000 metric tons in 1953 to about 630,000 metric tons in 1957. Annual production is expected to be 2 million metric tons by the end of 1960.

1959 Journal Survey of Petrochemical Plants—Worldwide 126

Here is the Journal's seventh annual survey of petrochemical plants, raw materials, and products. It's world-wide in scope for the first time. The survey is broken down into six tables, based on type of product. At least 150 expansions or new construction projects are either planned or under way. More than 100 of these are in the free world outside the U. S. and Canada.

TECHNOLOGY—OPERATION

Centrifuges Pass Tests as Separators 162

By M. J. Sergesketter

Shell has tested these machines both in the laboratory and in the field to see if they are practical for replacing the conventional heater-treater in removing produced water from crude oil on the lease. The tests have been successful, and there may indeed be a good place for electrically driven machines on some leases.

Making High-Quality Asphalt With a Propane Deasphalting Unit 166

By L. R. Reinkemeyer

Anderson-Prichard found that payout for a 3,000-bbl. per day propane deasphalting unit was assured, based on additional cat cracker charge, improved quality of this charge, and elimination of 250 bbl. per day of No. 6 fuel oil.

Motor and Gas-Turbine-Drive Centrifugal Compressor Stations 177

By Paul Reed and Gene Kinney

Texas Eastern Transmission Corp. is using successfully large electrical motors and gas turbines to drive large centrifugal compressors on the company's main gas line. The stations pump year-round at near design capacity to underground storage. Reliability during 3 years of operation has been very good.

Questions on Technology 184

What is adequate storage capacity?

New Graphical Methods to Check on Radioactive Tracers in Water Flooding 189

By G. E. Vaughn, Jr., and J. Wade Watkins

This new method based on assumed homogeneous reservoir conditions for a five-spot pattern determines arrival times at the production wells of any injected tracer. The concentration of tracer to be injected and optimum injection time can also be determined.

Oil-Base Mud Passed Test in Deep, Hot Hole 201

By J. P. MacEachern and Al Seaman

Oil-base mud was used on Shell's 3 Rumberger from 20,120 to 24,002 ft. It proved to be a stable system relatively easy to maintain. It increased hole stability and reduced mud costs.

Refinery Construction Indexes 203

The Journal's monthly indexes on refinery construction and operating costs.

Flash-Point Detectors for Quality Control of Pipeline Products 205

By James P. Polston

Standard Oil of Indiana now uses five different types for testing heating oils. The company has found the instruments to be very good investments in maintaining product quality at terminal locations.

the OIL AND GAS JOURNAL Newsletter

Tulsa, Okla.
Sept. 7, 1959

Oil men aren't being hurt yet by lack of steel:

Survey shows industry can go well into October without serious difficulty.

Some bigger companies have supplies to carry them through rest of the year.

Tightness, however, is developing in small-dimension and high-strength goods. There never was an oversupply of either. Oil men can get by with substitutes.

Foreign salesmen now say they're having some trouble peddling their steel. Two good reasons: Their prices have gone up and they can't promise quick delivery (p. 93).

▼ ▼ ▼

Two crude price cuts popped up last week:

...Union Oil posted a 10 to 50-cent a barrel cut on California crude and 30-cent cut on Four Corners (p. 102).

...Derby Refining and National Coop made a 15-cent cut on waxy crude in the Oklahoma Panhandle and Southwest Kansas.

Product prices in Group 3 are on the soft side.

Gasoline, which firmed up in the last part of the motoring season, is now moving slightly under published lows. Recent cuts on distillates have put heating oils under pressure.

Refiners aren't helping the price outlook any.

Their runs hit 8,362,000 bbl. daily last week, second highest on record.

Result was a 1,660,000-bbl. gain in gasoline stocks, 1,096,000-bbl. gain in kerosine, and 5,857,000-bbl. gain in residual. These inventories add more pressure on prices.

Look for more price increases in lubes.

A fairly sudden and unexpected tightening has taken place in lube markets within last 60 days. Marketers over the country report industrial and motor oils hard to find.

Credit for this refreshing turn of events is given largely to higher demand in spite of steel strike. Industrial oils particularly are scarce. But the situation includes all

solvent refined products. Some expect this firmness to remain through this year.

▼ ▼ ▼

Foreign exploration is getting hot.

Discovery on Sinai may help Egypt's dream of being a major oil power come true.

Sidri 4, drilled near Gulf of Suez, has come in good for 5,000 bbl. daily. Egyptians claim it's biggest oil hit ever made in the country (p. 114).

Major new oil field also appears to be shaping up in Algeria (p. 115).

The wildcat, El Agred 1, has been brought in as a producer. No other details were given by the French.

Well is a 9-mile stepout of El Gassi 1 discovery and is drilled on same large crescent-shaped structure. El Gassi was completed as a 2,540-bbl. daily producer.

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New Humble discovery in northeastern Bastrop County extends the Edwards lime trend of fields in South Texas nearly 40 miles northeastward.

It's first major stepout Edwards discovery in several years along the trend (p. 108).

Drilling elsewhere: McAlester basin in eastern Oklahoma should get a big play following Sinclair's strike at 1 Reneau in Latimer County. It flowed 1,100 M.c.f. daily on tests at 2,318-62 ft....Skelly is giving the northeastern tip of the Las Animas arch a boost. Skelly opened the Wilhelm Pennsylvanian field 2 weeks ago with the 1 Meyer in Rawlins County, Kans., and confirmed it last week with the 1 Wicks.

"Back-to-school program" for drilling crews has worked well for Great Western Drilling Co. (p. 104).

The firm pioneered a formal training program for its rig crews. In 3 years, it has found the training means more competent employes who can command better jobs and pay and have higher morale.

The firm has profited by the change as have the men.

▼ ▼ ▼

Final Borden Commission report recommends no government oil moves in next 12 or 18 months to let Canada's oil industry step up its production and sales (p. 109).

Failure to expand markets then would call for this action:

...Possible embargo on oil imports from Venezuela and Middle East now moving into the Montreal market.

...Building an Edmonton-to-Montreal crude line to carry Western Canadian crude to the eastern market. The commission favored government ownership of the 2,000-mile $370-million pipeline.

A new plan, meanwhile, is gaining support in Canada to bring Alberta crude to Montreal. It would:

...Use existing Interprovincial system to Toronto adding capacity where needed to boost runs by 100,000 to 125,000 bbl. daily.

...Then build new crude line from Toronto to Montreal to close the gap.

This would give part of the Montreal market to domestic crude and partially relieve Western Canada's market needs.

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Jersey Standard is combining all its domestic exploration, production, refining, and marketing operations.

Result is merger of Humble, Carter, Esso Standard, Pate Oil and Oklahoma Oil into one company using Humble name. Research will be handled by separate subsidiaries.

Reason: Greater efficiency and economy (p. 96).

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New interest in Alaska's Yukon-Kandik basin has been aroused by the first discovery in Canada's Yukon Territory.

The Canadian discovery, Western Mineral's Chance 1, is located in the same geological province as Yukon-Kandik area. The Chance 1 is 320 miles northeast of Fairbanks.

Following the Canadian strike, offers to lease were filed on 149,330 acres in the Yukon-Kandik with the Fairbanks Land Office.

Geological studies long have rated the Yukon-Kandik as one of the best oil potentials of any basin in Alaska.

Reports on key drilling in Alaska:

....Richfield will spud Kaliakh 1 this month along Gulf of Alaska in Yakataga-Katalla region.

...Anchorage Gas & Oil has spudded Rosetta 4.

...General Petroleum's important wildcat, Great Basins 1, near Becharof Lake on the Alaska Peninsula, is making good progress below 10,100 ft.

...Union-Ohio's Kenai 1 is below 13,575 ft.

...Alaska Consolidated's Zapa 1 in the Iniskin Bay area, is below 10,000 ft.

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Pipeliners are noting a trend away from telemetering so many functions of remotely controlled pumping stations.

One new station being built this year will go to the opposite extreme. It won't telemeter any temperature or

pressure. These have almost been standard heretofore.

Only indications at the control point will be that the unit is running or it's locked out.

▼ ▼ ▼

Petrochemicals are rocking along to another good year. Production is expected to increase 15.5% to 48.8 billion pounds. Value will gain 17.5% to $6 billion (p. 121).

By 1965 the demand for petroleum chemicals should grow to 85 billion pounds with value in excess of $10 billion.

Europe also is witnessing a growing petrochemical industry as a result of a big increase in refining. Production in the near future should satisfy domestic demands leaving surpluses for the world market (p. 123).

Petrochemical growth in all areas of the world are reported in The Oil and Gas Journal's annual plant survey (p. 126).

It shows the U. S. is still the No. 1 producer but the biggest expansion now is taking place outside this country. Of the 150 expansion or new projects currently underway, 100 are in the free world outside the U. S. and Canada.

Building activity especially is high in France, Italy, and England where gigantic projects are in the mill. Other important petrochem centers are developing in Australia, Argentina, and Japan.

The emphasis is on building polyethylene and polypropylene facilities.

▼ ▼ ▼

Note to refinery maintenance men: Wrap your tube bundles in polyethylene film before storing and you'll end your rust headaches.

Esso found that a protective rust coating followed by wrapping will prevent rust for an indefinite period. A desiccant is added prior to wrapping to absorb any moisture clinging to the tubes.

Tube bundles normally are highly susceptible to rust which can render them useless in a short time. Rustproofing alone gives only 3 to 4 months protection. When it's combined with the air-tight wrap, however, the bundle can be put on the shelf and forgotten until needed.

Residual import rules may be eased.

State Department favors action, thinking it may help mollify Venezuela. Interior Secretary Seaton is not so sure. He wonders if higher Venezuelan taxes haven't caused Venezuelan residual to lose ground to Middle East.

On imports controls generally, Seaton thinks they are achieving their basic purpose—to halt the downturn in domestic operations.

Good Wells Make Good News

A Monthly Report on Wells That Are Now Worth More

September 7, 1959

New well or old, oil well or gas — acidizing by Dowell is frequently the most profitable way to make wells worth more. Here are four recent examples of successful treatments.

- **Dawson County, West Texas** (Discovery Oil Well) This wildcat was completed into the Fusselman (Silurian) pay through perforations from 12,064 to 12,088 feet. Two lower sets of perforations tested water and were plugged back. 500 gallons of Mud Acid was followed by 1500 gallons Dowell regular acid with a demulsifying agent added. Then 3000 gallons of Retarded Acid were injected. The well potentialled 405 bopd through a 3/16-inch choke with a gas/oil ratio of 34 to 1.

- **Carter County, Oklahoma** (Old Oil Well) This well was perforated into two zones of the dense Bois D'Arc formation between 6637 and 6670 feet. Most wells in this area produce low volumes at high pressures. Production from this well had declined to four bopd. Dowell recommended 15,000 gallons of Retarded Acid to increase drainage area. This was followed by 5000 gallons regular acid. Injection rate was 12 bpm. After treatment production rose to 35 bopd.

- **St. Landry Parish, Louisiana** (Old Gas Well) Production had declined to 600 mcfd at 2500 psi from the Cockfield formation. Well bore damage was believed to be the cause of excessive draw-down. Dowell recommended a two-part treatment consisting of 2000 gallons Super Mud Acid with a silicate control agent added, followed by 1000 gallons regular acid with silicate control agent. Injection rate was 2½ bpm. Production after treatment rose to 2.5 mmcfd at 2600 psi tubing pressure.

- **Young County, North Texas** (New Oil Well) This well had been completed through perforations into the Caddo lime between 3987 and 3997 feet. It made only a show of oil. Since the oil-water contact was at 4007 feet, extreme care was necessary to avoid water production. Dowell recommended 1000 gallons inhibited acid with a fluid loss control agent. Injection rate was held to one bpm. After treatment, the well tested 78 bopd with no water, flowing through a 13/64-inch choke.

If you have a well that needs stimulation, call your nearest Dowell representative. He may recommend an acidizing treatment tailored to your well, or he may suggest another Dowell treatment. In any case, you can be sure of competent engineering help. For service or detailed information, contact the Dowell office or station nearest you. There are more than 165 locations in the United States, Canada, Venezuela and Argentina. Dowell, Tulsa 1, Oklahoma.

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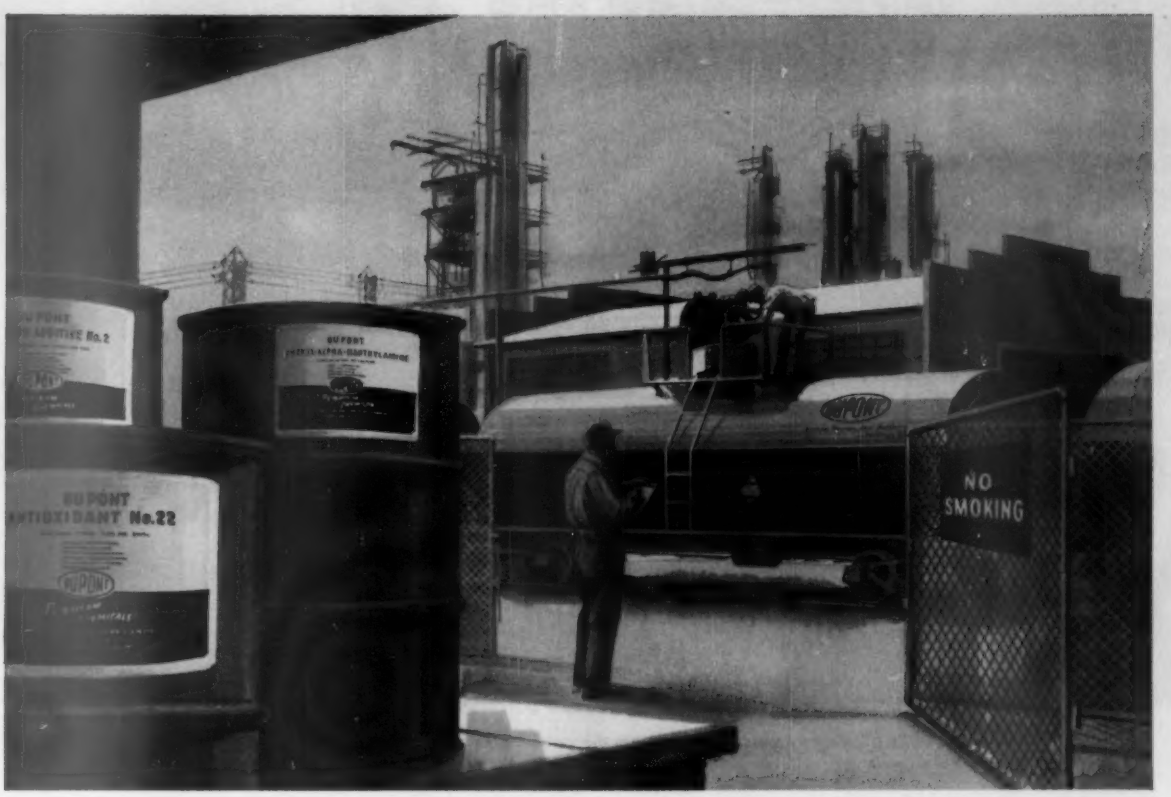

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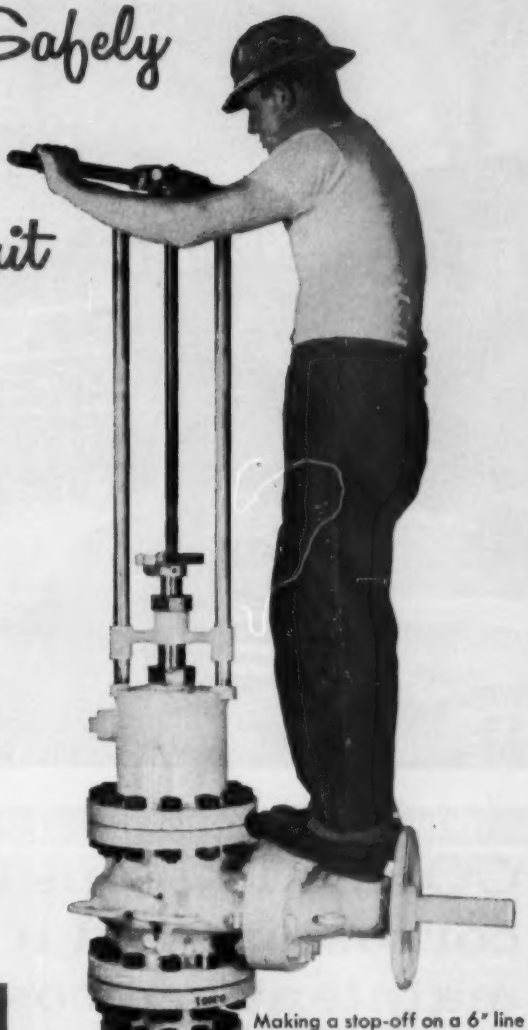
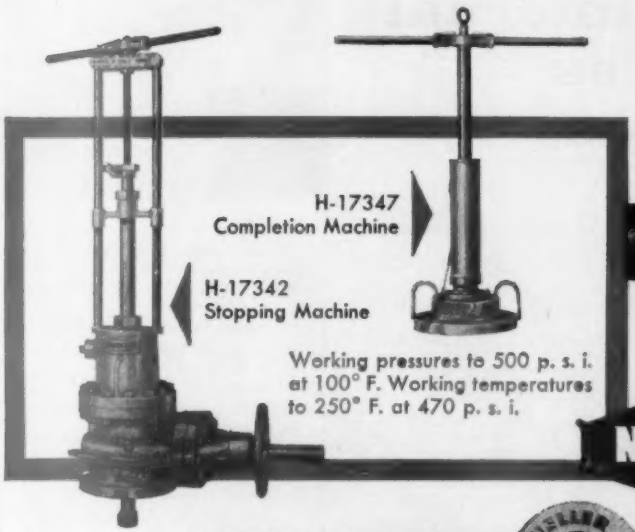


Making a stop-off on a 6" line with a Mueller H-17342 Stopping Machine.



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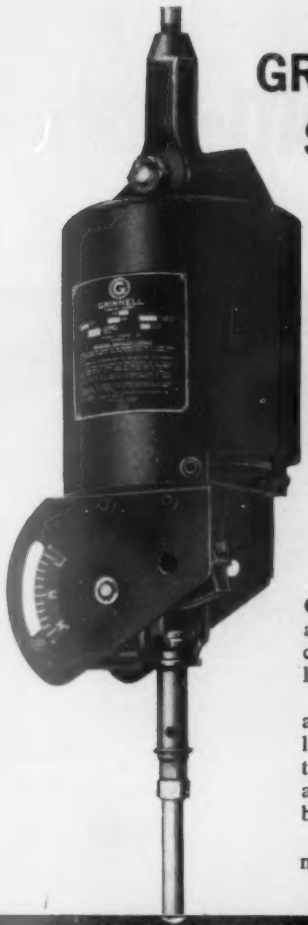
GRINNELL CONSTANT SUPPORTS...



2 BASIC DESIGNS...

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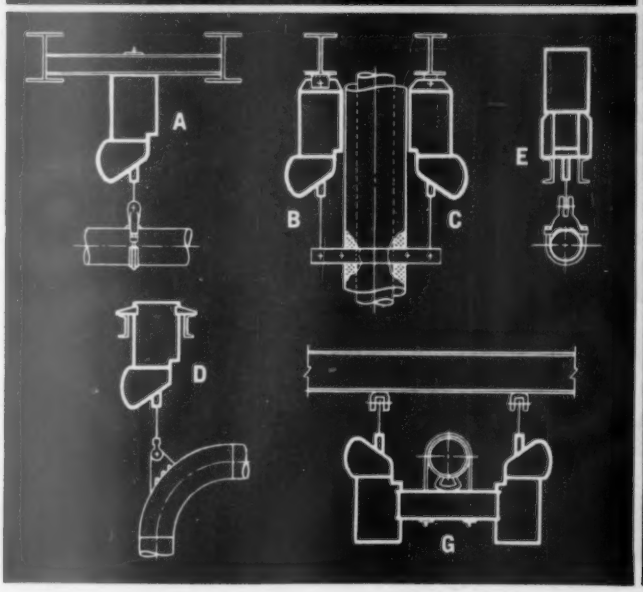
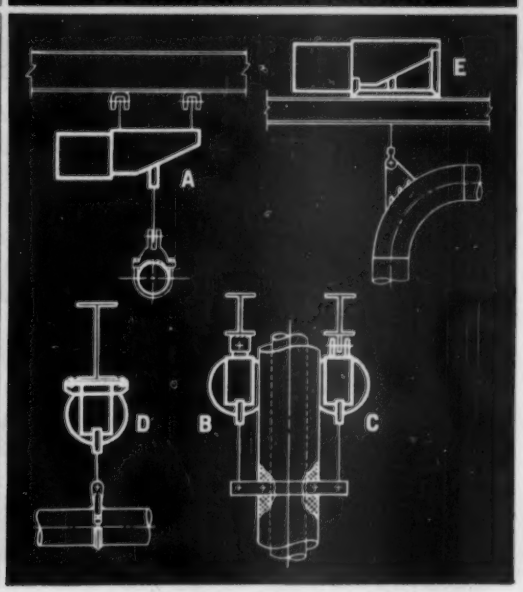


FOR HORIZONTAL ATTACHMENT



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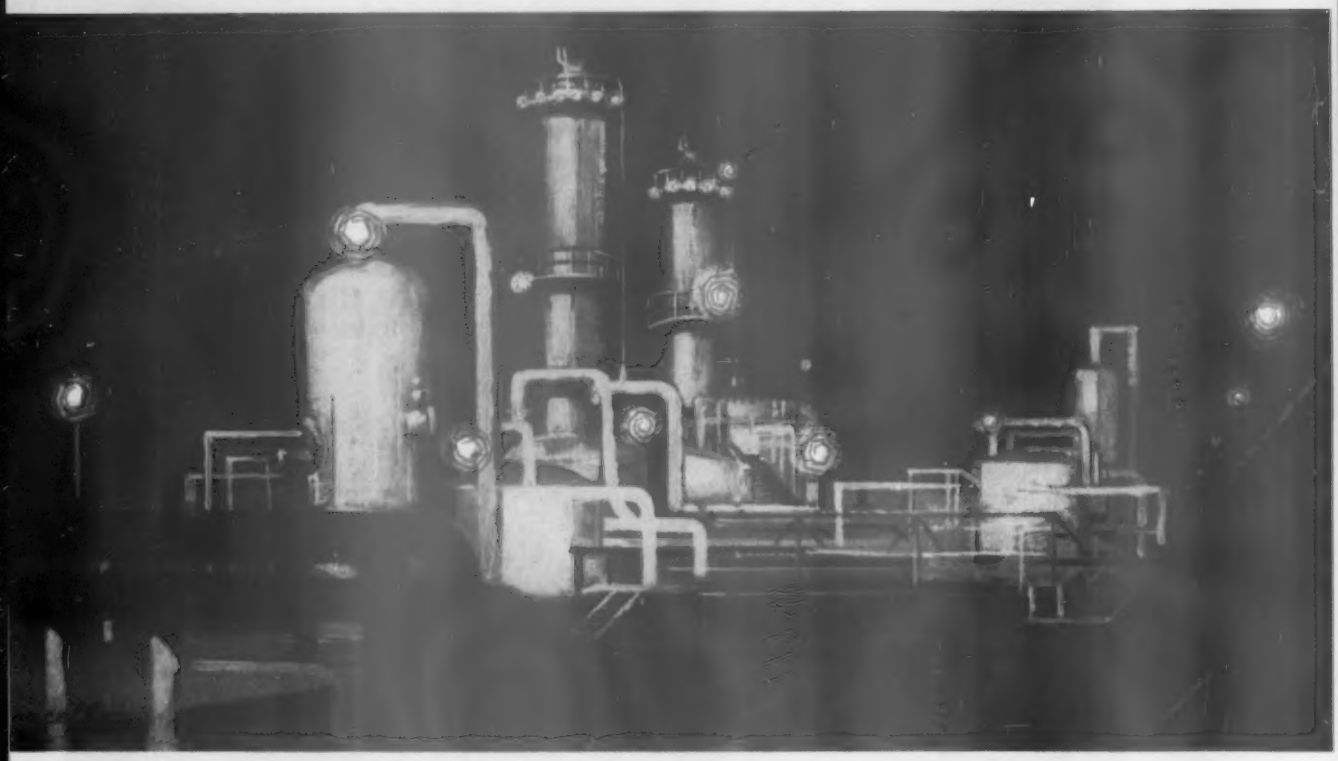
A refinery never sleeps

Twenty-four hours a day, a refinery is in operation. Its hundreds of miles of tubular products are constantly subjected to high temperatures and tremendous pressures. In order to survive under conditions like these, the tube must be hand-picked for the job. And, that's where National Tube comes in. If you need advice in refinery tube selections, get in touch with National Tube.



Our experience in this field comes from more than 60 years of gathering information for the solution of refinery tube problems. And, we've used this data to develop 24 different seamless steel tube analyses—each one the answer to a specific set of refinery conditions. Other chemical compositions are also available in tubular products, and a wide variety of high temperature problems are under study.

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Carbon ½ Mo	5 Cr, ½ Mo, 1¼ Si	18-8
1 Cr, ½ Mo	7 Cr, ½ Mo	18-8 Ti
1¼ Cr, ½ Mo	8 Cr, ½ Mo	18-8 Cb
2 Cr, ½ Mo	8 Cr, 1 Mo	18-8 Mo
2¼ Cr, 1 Mo	9 Cr, 1 Mo	25-20
2¼ Cr, ½ Mo, ¾ Si	12 Cr	3½ Ni
3 Cr, 1 Mo	12 Cr, Al	5 Ni

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You can tailor-make wrenches for any job ... big or small ... hand or power ... in a matter of seconds. From tiny assemblies to massive structural work, Williams broad line of Supersockets®, Power Drive Sockets and Superector® Wrenches covers the full range of openings from 3/16" to 4-5/8" for hex and square nuts.

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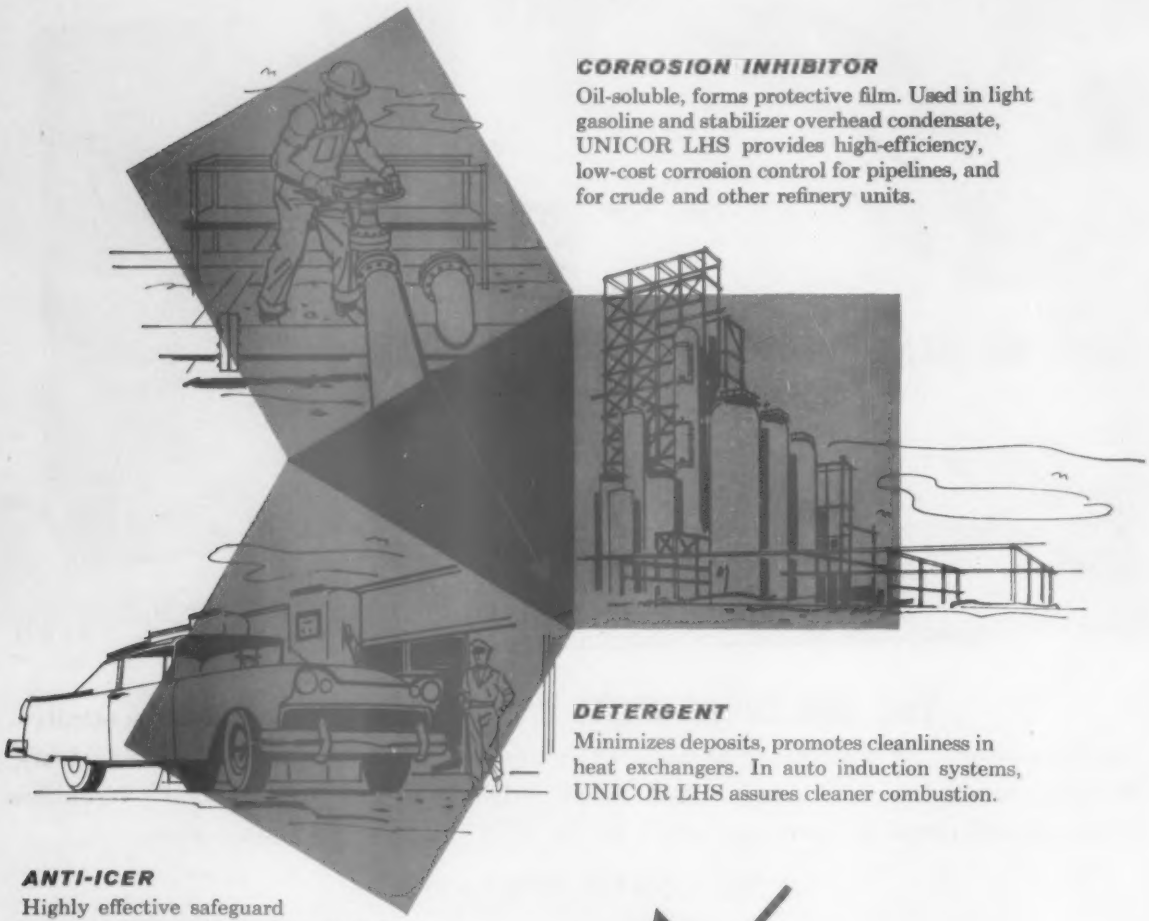
415 VULCAN ST., BUFFALO 7, N. Y.

New... ...triple-purpose anti-icer

UNICOR LHS®

provides valuable refinery and pipeline service, too!



CORROSION INHIBITOR

Oil-soluble, forms protective film. Used in light gasoline and stabilizer overhead condensate, UNICOR LHS provides high-efficiency, low-cost corrosion control for pipelines, and for crude and other refinery units.

DETERGENT

Minimizes deposits, promotes cleanliness in heat exchangers. In auto induction systems, UNICOR LHS assures cleaner combustion.

ANTI-ICER

Highly effective safeguard against carburetor icing, prevents stalling. UNICOR LHS is convenient and economical to use, and is instantly miscible in lightest components of winter-grade gasolines.

Get the facts today! Write or phone for information and samples. Address our Products Department.

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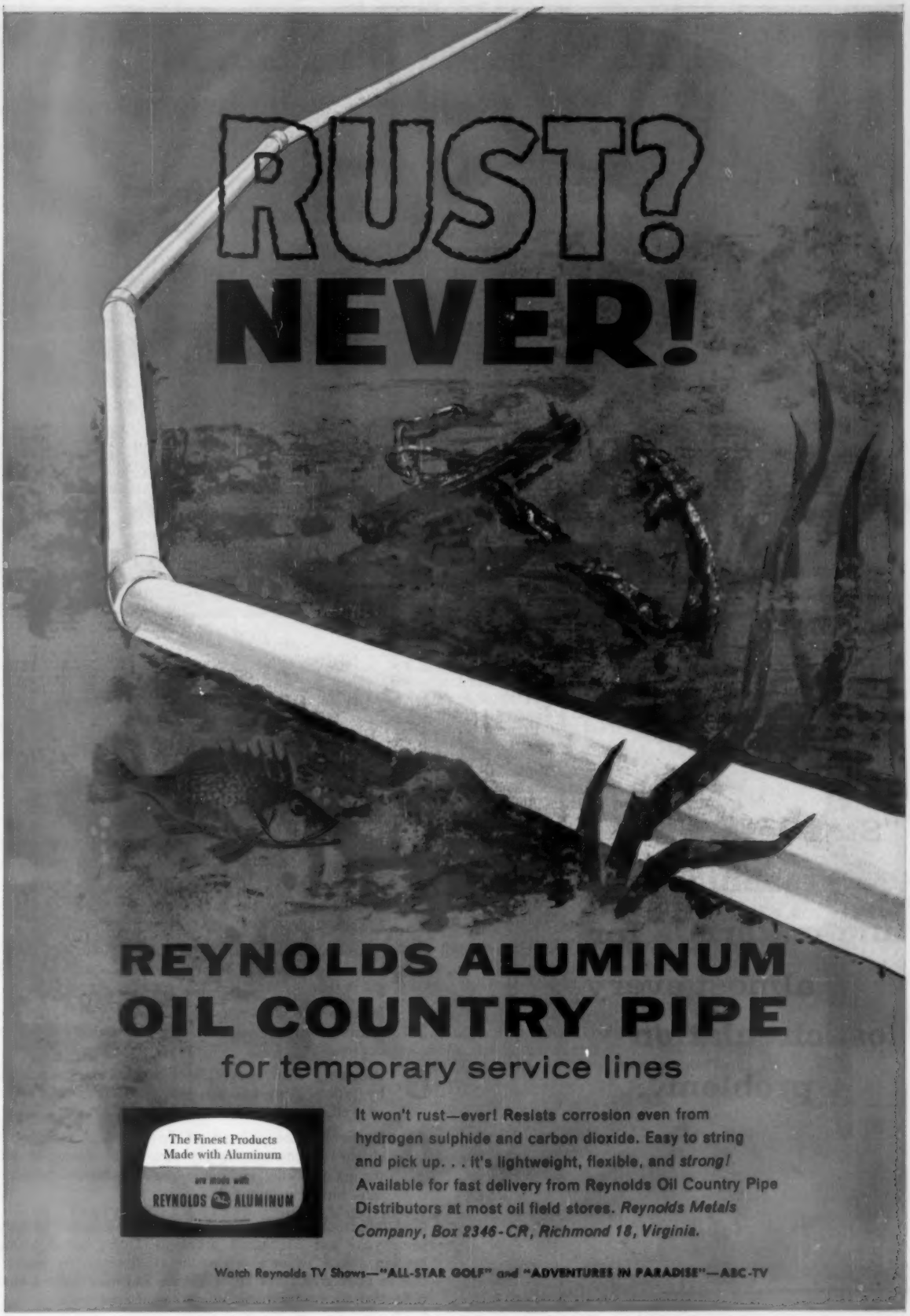
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It won't rust—ever! Resists corrosion even from hydrogen sulphide and carbon dioxide. Easy to string and pick up. . . it's lightweight, flexible, and strong! Available for fast delivery from Reynolds Oil Country Pipe Distributors at most oil field stores. Reynolds Metals Company, Box 2346-CR, Richmond 18, Virginia.
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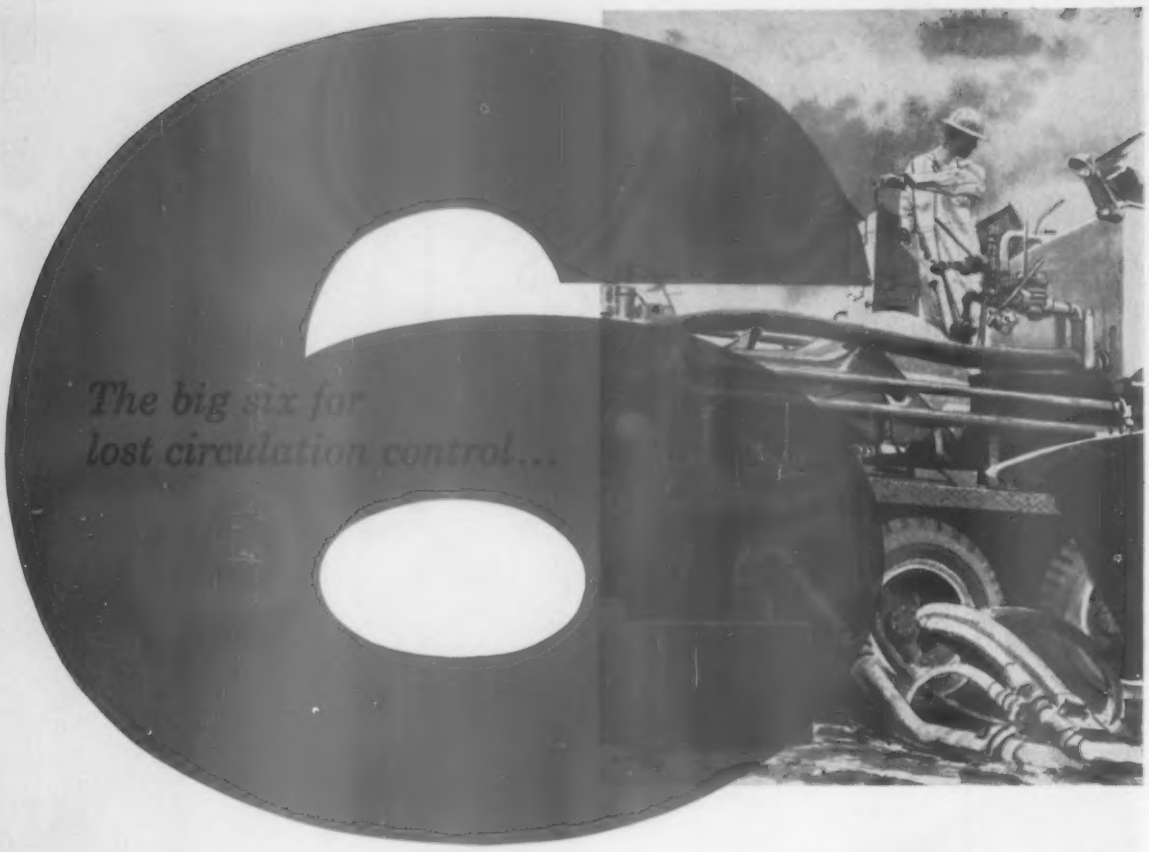


"Stop-loss" techniques and materials for almost every lost circulation problem...

There is no single solution to all lost circulation problems... as lost circulation, a continuing loss of drilling fluid or cement into excessively permeable formations, crevices, fissures or vugs may result from a variety of causes. Halliburton offers six basic "stop-loss" techniques that restrict such losses to a minimum – in virtually all types of formations:

1. Plugging with quick-setting cements and resins which set up while flowing into and through channels.
2. Squeezing with special material which builds up viscosity until it becomes a stiff gel, which can then be extruded.
3. Squeezing with an easily pumpable fluid that maintains a low viscosity until it starts to set. A very stiff gel is then formed in a few minutes.
4. Blocking circulation loss channels with flaky, fibrous, granular or gelling additives to drilling mud or cement.
5. Blocking with special slurry which thickens by hydration. Waterless slurry is pumped to thief zone of well, then hydrated.
6. Lightening the column of drilling fluid or cement slurry to decrease the pressure which forces it into formation. This technique may be combined with bulk blocking materials.

Halliburton "stop-loss" techniques are designed to help solve *your* lost circulation problems. Don't go on losing drilling dollars when a call to the Halliburton representative in your area takes but a minute and may make a real difference in the profitable operation of your well.

Effective "stop-loss" techniques result from effective materials such as these...

FOR WEIGHT REDUCTION...

Gilsonite—A new granular additive for all types of cementing compositions, with excellent lost circulation control characteristics through reduction of slurry density and outstanding bridging properties. With a specific gravity of 1.07, Gilsonite adds volume, not weight, to cement slurry, resulting in light weight slurries having high compressive strength at low temperatures. 25 to 50 lbs. per sack of cementitious material is generally an optimum amount required. Resistant to water and brine corrosion and to attacks of acids or alkalies; has a high insulating value against electric currents. Gilsonite may be used with portland cement with or without bentonite, Pozmix Cement or Pozmix 140.

FOR PLUGGING...

Cal-Seal with Portland Cement—Mixed with portland cement, Cal-Seal, a super-strength gypsum cement, sets quicker and aids in sealing off circulation loss zones of shallow depths where temperatures are relatively low. For higher temperatures, straight portland cement with or without Halliburton HA-5 Accelerator sets quicker and is often more effective for Lost Circulation.

Hydro-Lok (PC-11) and (HG-10)—Originally developed as water control agents, Hydro-Lok materials have been used successfully many times to control troublesome lost circulation conditions in naturally fractured formations. These Hydro-Lok materials are insoluble in acids and well fluids. Hydro-Lok (PC-11) is a plastic slurry consisting of a resin mix and inert solids; HG-10 is the resin material alone.

FOR SQUEEZING...

Hydro-Lok (PWG)—Unset Hydro-Lok (PWG) is a low viscosity fluid and this viscosity is maintained throughout 95% of its pumping life. When PWG enters its setting phase, a very stiff gel is formed in a few minutes. Such a material has given successful results in certain problems of lost circulation. The setting of PWG can be adjusted to fit formation temperatures between 32° and 200°F.

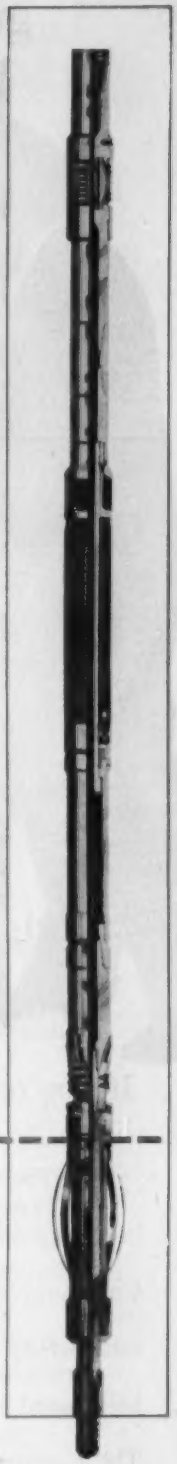
FOR BLOCKING...

Tuf-Plug—A special blend of graded ground walnut shell used as an additive in drilling fluid or cement, Tuf-Plug often provides an effective seal to shut off wide fractures... its strength helps support high columns of cement behind the pipe.

Diesel Oil Cement (DOC)—Diesel Oil Cement is a mixture of portland cement, diesel oil and an effective chemical dispersant. Pumped to a thief zone, DOC slurry quickly thickens... the water penetrated slurry will then set to give a stronger and more permanent plug than many other lost circulation materials. Particularly effective for fractured conditions and in difficult zones of very high permeability. Small cavities may also be plugged.

Flocele—Flocele is a chemically inert cellulose film flake which, when added to cement slurries, does not affect pumping or setting properties, yet effectively bridges and seals most fissures and other thief zones. It helps prevent or lessen the loss of expensive cement or drilling fluid into many permeable formations during casing cementing. Economical, too, since normally 1% or less of Flocele is sufficient. ⅜" flakes are recommended for use in cement and ¾" flakes in drilling fluids.

Bentonite Diesel Oil (BDO)—A thin slurry of bentonite in diesel oil... pumped down the drill pipe to mix with the drilling mud forms a sticky, putty-like material that usually plasters over the zone and helps shut off circulation loss permeability.



and an efficient tool...

Open Hole Treating Packer—For treating lost circulation zones in open holes, with just one trip into the hole. Can be set, moved and re-set until zone is pin-pointed, then blocking agent is placed through same packer. Lengthy anchor is not necessary because lateral expanding slip assembly makes this unique packer completely independent of the distance from the bottom of the hole.

HALLIBURTON
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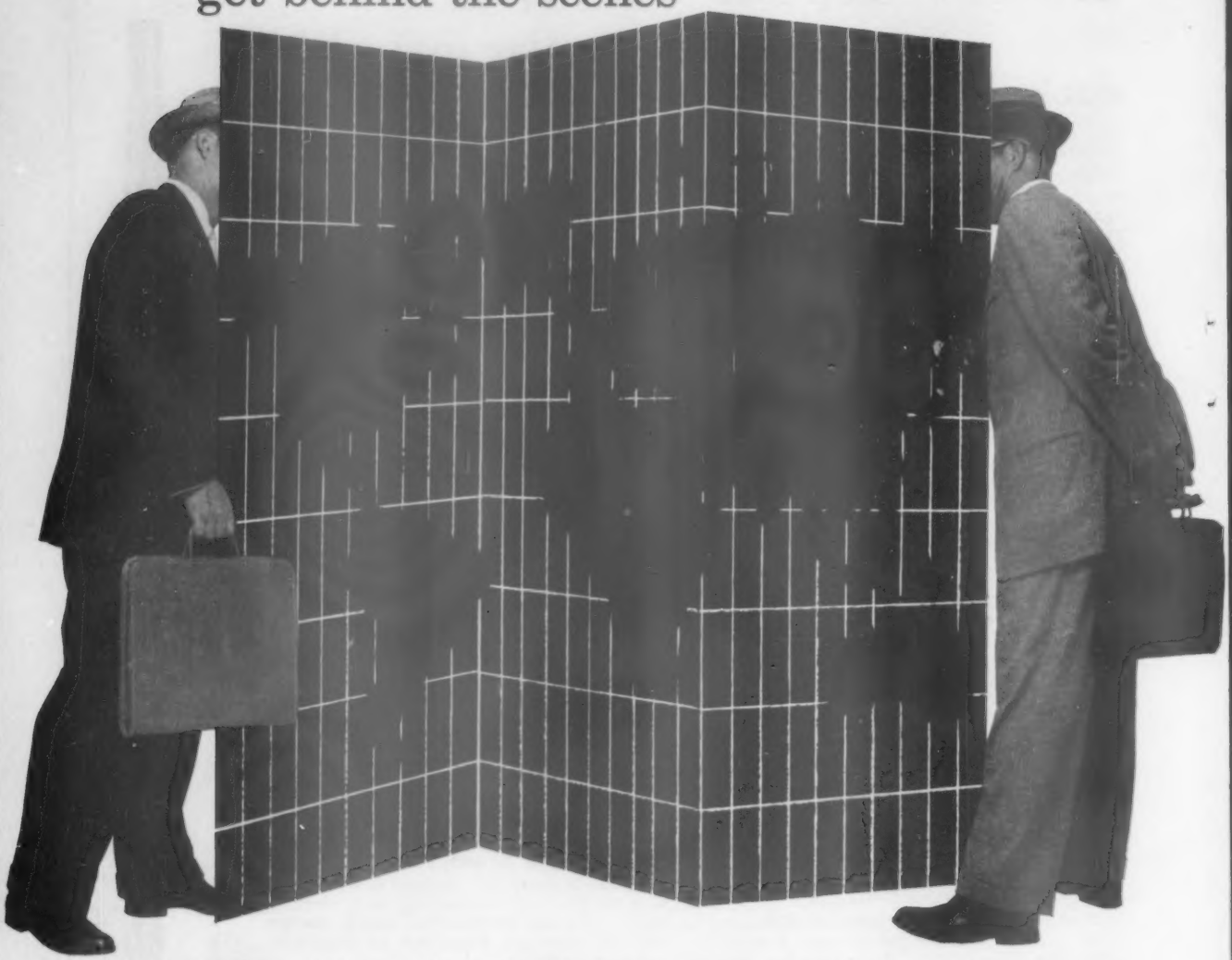
"284 Service Centers—Just Minutes Away From Your Well"

get behind the scenes



If you're branching out or drilling overseas come to The Commerce

There's so much you'll want to know, and there's no reason for finding it out the hard way. The Oil and Gas Loan Department and International Banking Department of The Commerce can guide you every step of the way. Whether you're setting up a sales office, establishing a plant, or are going to drill overseas, you'll get up-to-the-minute advice and help based on years of experience working with others who are overseas now. Working with The Commerce and its overseas correspondents, you'll get the specific, detailed kind of help that can mean profitable foreign operations.

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Your stack carries away regeneration gases —not catalyst—when you put Davison in your unit. Here's why:

With Davison Catalysts you get the lowest amount of unretainable fines.

With Davison Catalysts you get lower attrition. The lower breakdown rate of Davison Catalysts means you get the fines you need without light particles escaping up the stack.

The reason: *balanced density.* There's a Davison Catalyst to suit your application. Write Department 401p, today for Product Service Bulletin No. 59-101.

Department 401p

W.R. GRACE & CO.
DAVISON CHEMICAL DIVISION
BALTIMORE 3, MARYLAND

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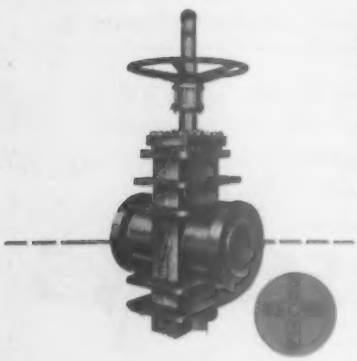

Here's the valve you set and forget. Grove's exclusive Seal-O-Rings wipe out the need for valve lubrication. You're never stuck with valve failure because of forgotten lubricant or depleted sealing compound. The load of lubrication is gone forever. Specify Grove Seal-O-Ring Gate Valves. Under pressure the tightest seal in the line.

Grove valves never require lubrication

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COMPRESSOR QUIZ

Take this 5 minute quiz and check your knowledge of balanced opposed compressors.... ANSWERS ON NEXT PAGE. NO PEEKING!

1. What is the reason for an outboard bearing supported motor?
- ☐ Accessibility
- ☐ Shaft alignment
- ☐ Weight saving

2. Which design provides the smallest force couples?
- ☐ Bearing between the crank throws
- ☐ No bearing between the crank throws
- ☐ Both are equal

3. Structurally, what's the critical point in the multi-crank horizontal compressor from a design viewpoint?
- ☐ Lateral forces in the frame
- ☐ Vertical forces in the frame
- ☐ Cylinders

4. What type of motor is usually used on a balanced opposed compressor?
- ☐ Induction
- ☐ Engine-type synchronous
- ☐ Wound rotor

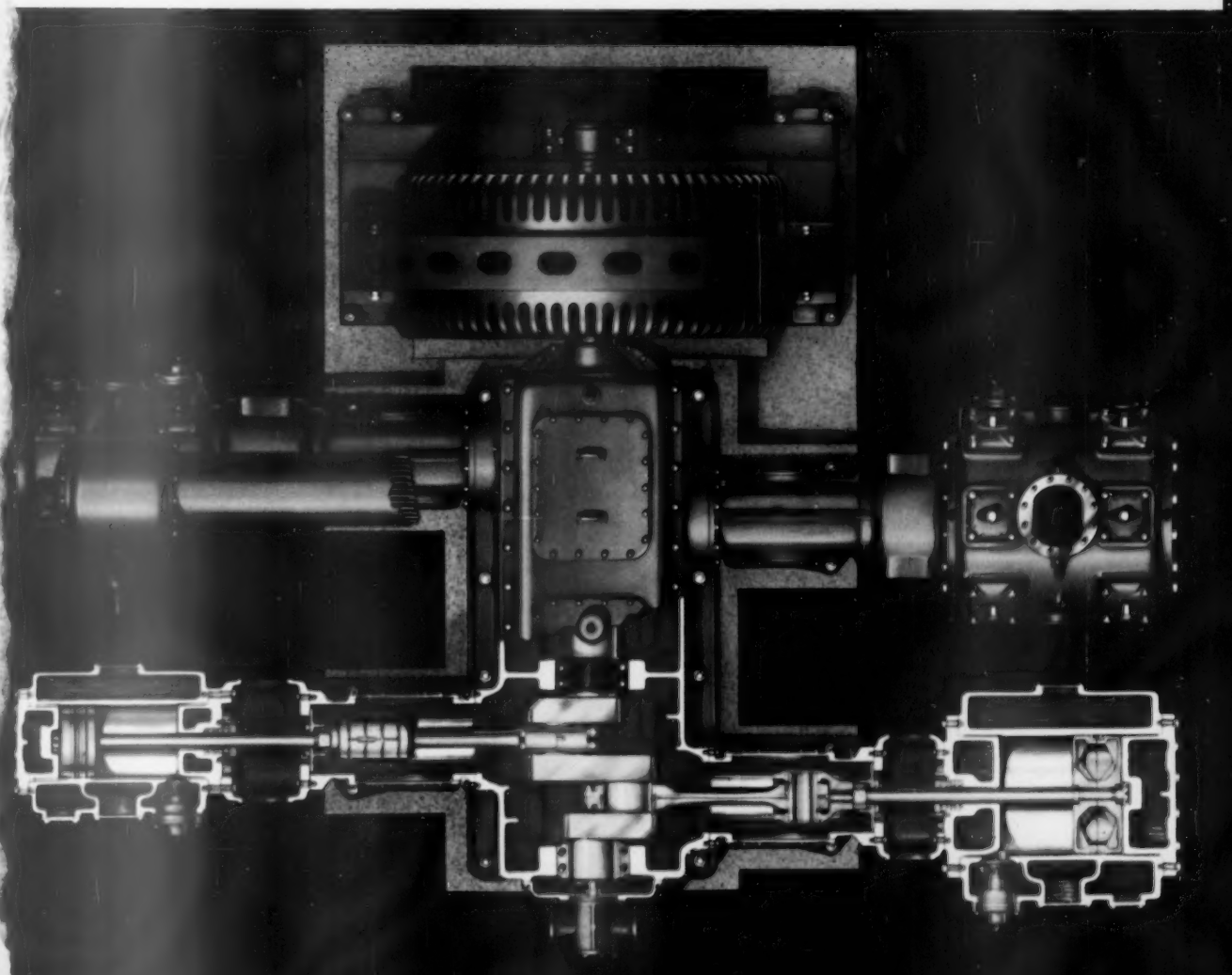
5. Can machine-mounted coolers and inter-stage piping be factory pre-fitted?
- ☐ Yes
- ☐ No
- ☐ Only on simple arrangements

6. Why is the balanced opposed compressor easier to install than other types of equivalent size?
- ☐ Lighter weight
- ☐ Less parts
- ☐ Semi-packaged design

7. Is it common practice to install more than one compressor service on a single multi-cylinder frame?
- ☐ Yes
- ☐ No

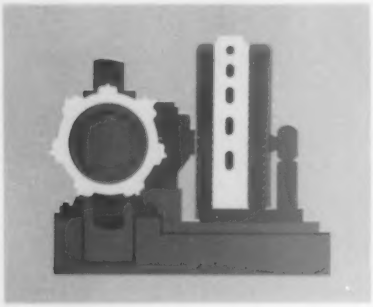
8. Industry's most preferred compressor valve is standard with Worthington. It is:
- ☐ A plate valve
- ☐ A spring activated valve
- ☐ A Feather Valve

WORTHINGTON



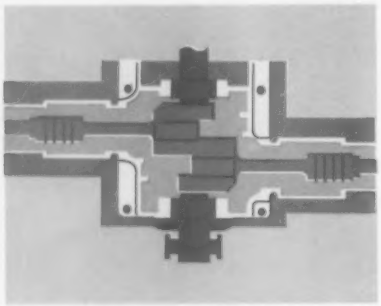
ANSWERS

to key compressor questions on previous page



1. What is the reason for an outboard bearing supported motor?

Ans: Shaft alignment. Secure and permanent support of the large synchronous motor rotor is best obtained by placing a bearing on each side of the rotor.



2. Which design provides the smallest force couples?

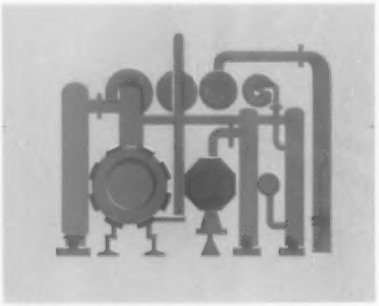
Ans: No bearing between the throws. Worthington's adjacent crank design reduces couple arm to a minimum.

3. Structurally, what's the critical point in the multi-crank horizontal compressor from a design viewpoint?

Ans: Lateral forces in the frame which tend to distort the frame. Worthington's precision machined and fitted tie bars give solid support to the frame, preventing misalignment due to distortion.

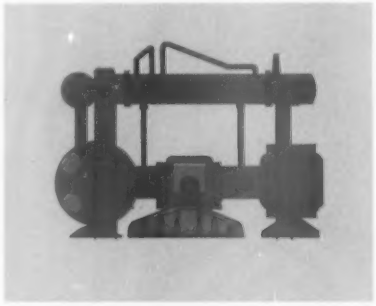
4. What type of motor is usually used on a balanced opposed compressor?

Ans: Engine-type synchronous is the major application; but complete flexibility of Worthington design permits use of any type driver, including turbine and gear or power engine.



5. Can machine mounted coolers and interstage piping be factory pre-fitted?

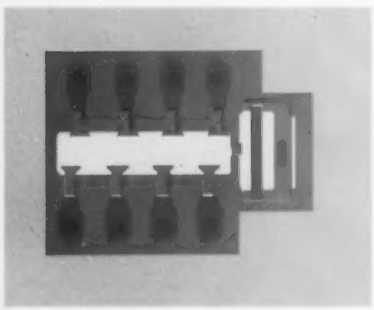
Ans: Yes. In fact, when overhead mounted piping and coolers are furnished by Worthington, such piping and coolers are always completely assembled and fitted to the compressor before it leaves the factory.



6. Why is the balanced opposed compressor easier to install than other types of equivalent size?

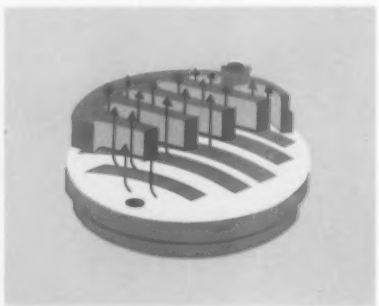
Ans: Semi-packaged design. Self aligning features permit easy and sure crankshaft, frame, and motor alignment on simplified foundation. Pre-fitted coolers and piping eliminate many problems associated with multi-stage compressor installation.

SCORING: If you got 7 or 8 questions right you're up-to-date on balanced opposed compressors and you recognize the value of the Worthington machine. If you got 5 or 6 right you're acquainted with some of the benefits of Worthington equipment, but you need brushing up. If you got less than 5 right, get in touch with your nearest Worthington technical representative. He'll give you the full story on the many advantages of the Worthington design. Worthington Corporation, Harrison, N. J. In Canada: Worthington (Canada) Ltd., Brantford, Ont. 36.5



7. Is it common practice to install more than one compressor service on a single multi-cylinder frame?

Ans: Yes. Particularly where the compression services are related, as in chemical plants. The arrangement results in substantial savings in initial plant cost.

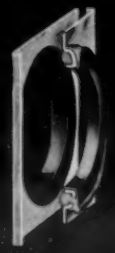


8. Industry's most preferred compressor valve is standard with Worthington. It is:

Ans: Feather Valve! By actual count of 2 to 1, this outstanding compressor valve is preferred by operators and engineers.

WORTHINGTON

The Seats are the



W-K-M's NEW *Pressure Sealing* GATE VALVE

ASA 150 lb. (275 cwp)
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Approved for many services including:

air • gas • water • butane/propane gasoline • kerosene • alipathic alcohols aliphatic hydrocarbons • animal and vegetable oils • crude oils • naphtha • glycerol ethylene glycol.

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Line Pressure Seals the Seats

The seats — made of specially formulated rubber molded to a hardened steel insert — are the secret to the valve's tight sealing performance. As line pressure in the valve increases, these unique seats actually float with the pressure to seal tightest where the most pressure is exerted.

Important Safety Feature

Excessive body pressure caused by thermal expansion is automatically relieved. The upstream seat is forced away from the gate by the excess pressure, allowing it to bleed into the line.

Change Seats in Minutes—on the line

You can change seats in W-K-M's Pressure Sealing Gate Valve (2″ through 12″) in 15 to 30 minutes . . . *on the line.* The only tools needed are a wrench and a pair of pliers.

Full Bore, Through-Conduit

Full bore, through-conduit gate construction permits a smooth flow with no more turbulence or pressure drop than through an equal length of pipe. The seats are fully protected from abrasive action of the lading flow.

Available Now

This versatile valve is available at leading supply stores everywhere. It's designed for pressures up to 720 psi (cwp) and temperatures up to 250° F.

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The big buy is still SIOUX. The advantages of SIOUX mechanical design are available in the electric impact wrench too. You get equal power in right or left hand rotation. SIOUX pioneered the reverse cap switch lock that prevents reversing with the current on, eliminates burned commutator brushes and switch contacts. You get SIOUX performance and dependability too!

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SIOUX tells you the torque your air or electric impact wrench will deliver. You don't buy just a wrench. You buy certified SIOUX power! If it's a SIOUX you know what it will do!

Don't miss the big buy in impact wrenches
Ask your nearest SIOUX distributor for a demonstration!

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ENGINEERED EVEN BETTER . . NOT JUST BUILT

Designed to conform with recent API proposed standards

After exhaustive tests, field pumping is a breeze for C-E units. So thorough are these tests that every possible well condition is duplicated . . every critical stress area checked with modern electrical strain gauges. Performance tests prove C-E's engineering reputation . . Engineered EVEN BETTER . . not just built.

Here's what these new features mean to you

HIGHER SAMSON POSTS . . increase operating efficiency through improved geometric design . . permit more efficient well counter-balancing. A maximum 1.06 torque factor has been attained by this design for all units.

MORE FLEXIBILITY . . 18 different units make it possible to apply the right unit to any well load for lower initial and operating costs . . a wide variety of stroke lengths is available for all pumping requirements . . any type of prime mover can be used to take advantage of gas or electricity, whichever is lower in cost.

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NEW WRIST PIN AND PITMAN CONNECTION . . Permits faster field assembly and speeds up changing stroke length. Pitman attaches to wrist pin bearing housing with through bolts. Tightening the bolts brings the parts together accurately and simply.

NEW BEARING ASSEMBLIES . . Pre-lubricated and sealed structural bearings eliminate contamination from field greasing (an optional feature). All bearing applications are based on manufacturer's B-10 life ratings.

QD SHEAVES, STANDARD . . available anywhere, these sheaves are lower in price than special sheaves.

STRUCTURAL CAPACITIES . . from 5,300 lbs. to 29,000 lbs. in 18 sizes. A unit pumper size for every well.

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Representatives in All Principal Oil Fields of the World

DOW | **Cracking plant for petroleum problems**

Oil and gas companies are finding, lately, that they're getting a lot of valuable help from people who aren't on their payroll. Here at Dow, for example, the complex problems of the petroleum industry are being simplified continually by the "cracking plant" of chemical research. These news reports will keep you posted on current developments which may prove profitable to you.

You may wish to check certain items in this advertisement and forward to those concerned in your own company.

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DOW CLINIC SPECIALIZES IN GAS CONDITIONING PROBLEMS

Skelly Oil Company keeps its gas treatment in healthy shape by sending its amine solutions for regular check-ups. Other firms also profit from service of Dow Gas Conditioning Lab.

They run a unique clinic at Midland, Michigan. The "patients" are problems . . . problems brought here by gas conditioning companies.

"You don't have to be in serious trouble to benefit from this service," says a member of the Gas Conditioning Laboratory staff. "We're happy when even a small contribution from us helps a customer improve the overall efficiency of his processing plant."

The Skelly Oil Company is a case in point. Skelly has regularly submitted samples of the monoethanolamine solutions used in their gas processing plants for analysis. Complete data on the corrosion and foaming characteristics of these solutions have been helpful in overcoming production difficulties.

A user of activated carbon filters in their amine units, Skelly also has drawn on the resources of the Dow laboratories for reports on the type of materials removed by these filters and the approximate capacities of carbon filters.

Answers for the Industry—The case histories of successful remedies prescribed by the Dow lab are invaluable in helping solve problems for the gas conditioning industry. In fact, these case histories point to leadership in the gas conditioning field. Should you be looking for answers to a long list of processing problems, including high temperature corrosion, glycol contamination, salt contamination, high glycol losses and solidification of paraffin, you, too, may want to look to Dow.

Armed with case histories of successful remedies prescribed by the Dow laboratories, plus a host of additional data, the Dow technical serviceman leaves on a trouble-shooting call equipped to do the job.

If the customer's problem has been solved before, the Dow man carries the solution in his brief case. If the problem is a new one, he'll know it's new without trial and error probing—and refer it to his technical laboratory for the same clinical analysis which has turned problems into profit so many times before.

Those who may have experienced difficulties or doubts in connection with gas sweetening and dehydrating processes would do well to consult this "free clinic" at Dow. The prognosis is generally bright. As one laboratory supervisor said: "We haven't lost a patient yet".

Samples of monoethanolamine solutions from the Skelly Oil Company are tested in Dow Gas Conditioning Laboratory.

DOWTHERM 209

Ebullient cooling comes of age

Owners and operators of large internal combustion engines laboring in the refining and chemical processing industries can look forward to longer engine life and improved performance. These are the benefits of using Dowtherm® 209, the new, freeze-point depressant for ebullient cooled engines.

Wherever freezing problems exist, Dowtherm 209 and ebullient cooling offer the advantages of uniform heating, faster engine warm up, automatic circulation and temperature control, reduced corrosion and lubricant contamination—not to mention the use of waste heat for low pressure steam.

Freezing problems which had prevented ebullient cooling from achieving widespread application have been overcome by Dowtherm 209. With a boiling point of 209°F., it also permits engines to run at higher, more efficient temperatures . . . on cheaper fuels. Uniform heat transfer provides even cylinder wall temperatures—with reduced "blow-by" (oil blowing past piston rings).

Dowtherm 209 azeotropes with water. The azeotropic mixture has a boiling point of 209°F. It provides freeze protection to a −45 or −80°F. as required. Special inhibiting action minimizes corrosion.

Engineers have already reported many profitable changeovers to ebullient cooling with Dowtherm 209. In about ninety-five per cent of the cases, conversion is a simple matter.

★ ★ ★ ★

For more information on these and other chemicals important to the oil and gas industry, contact the Dow sales office nearest you or write THE DOW CHEMICAL COMPANY, Midland, Michigan, Chemicals Merchandising Department 953DC9-7.

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Glycols • Polyols
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Weed, Grass & Brush Killers

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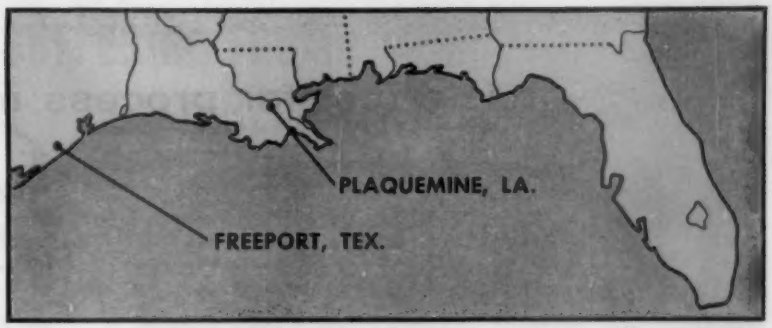
Midland, Michigan

DOW



CAUSTIC SODA *Within arm's reach of offshore developers*

"Closest with the mostest," pretty well sums up the supply situation of Dow caustic soda for the Gulf Coast offshore petroleum development area.

Two Dow producing plants—at Freeport, Texas, and Plaquemine, La.—are within arm's reach of this industrial giant in the Gulf region. The petroleum industry's appetite for caustic soda is enormous. But it always finds supplies from Dow ready and waiting.

"You might call us the caustic soda logistics experts for the petroleum industry," a Dow spokesman said. "Wherever they set up shop, the Dow caustic supply line is already there."

Explore these other

PROFIT POSSIBILITIES

CHLOROTHENE®

New, high cleaning power for general equipment cleaning. Safety features make it best solvent for cleaning electric equipment. Ask about Chlorothene (Dow 1, 1, 1-trichloroethane, inhibited).

DOWICIDE®

These Dow preservatives protect drilling muds with a high starch content from decomposition in open storage at the drilling site. Also used to control slime, fungi, algae in cooling towers.

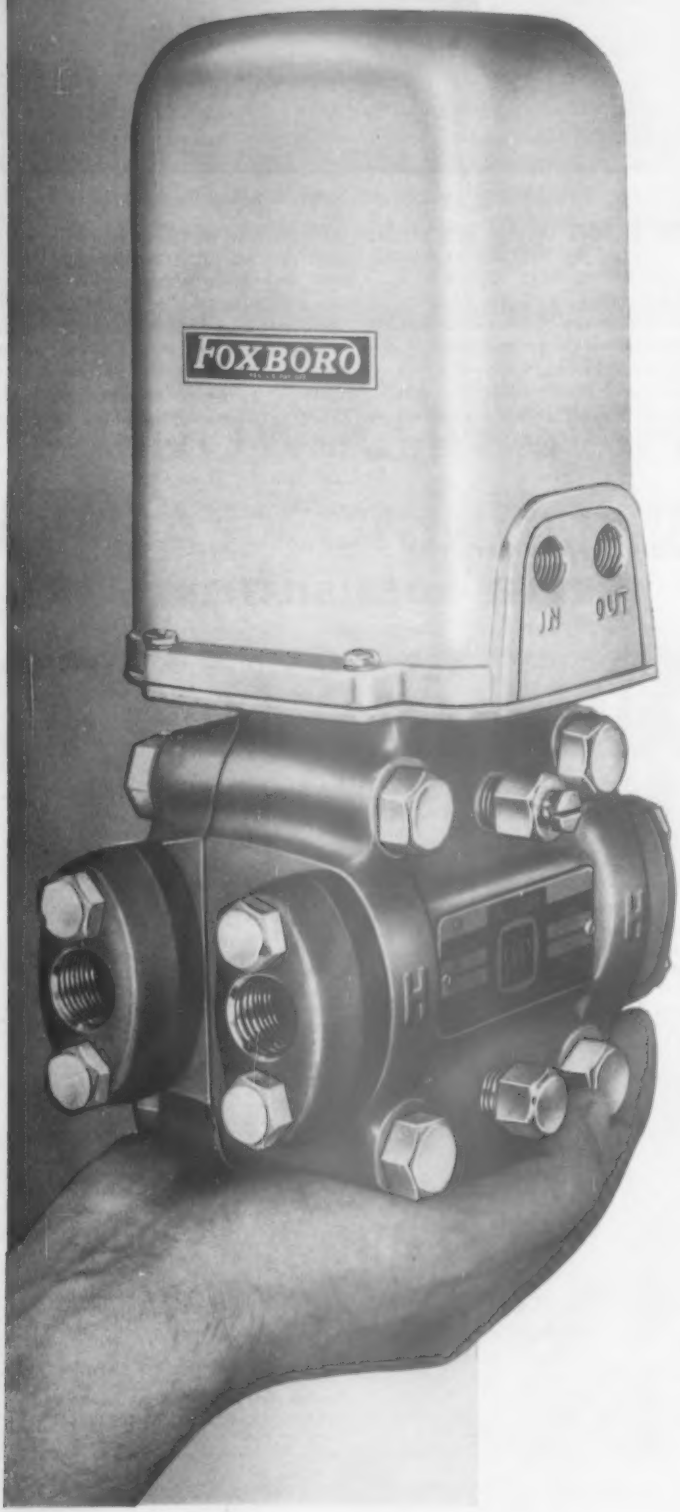
PENTACHLOROPHENOL

New 12 page booklet—"Low-Cost Pole Buildings for Industry"—describes in detail low costs and long lasting benefits of penta-treated pole buildings. Write for copy today!

AMMONIA

Dow is source of high quality ammonia for use as corrosion inhibitor in cracking stills, bubble towers, straight-run fractionators. Controls hydrogen sulfide corrosion at lower cost than coatings.

basic tool for process measurements . . .



FOXBORO d/p CELL* TRANSMITTERS

Positive overrange protection . . . no perceptible zero drift . . . high sustained accuracy, even under the most punishing operating conditions.

D/p Cell bodies are available in 316 s.s. or rustproofed carbon steel. Unique stainless steel twin-diaphragm capsule is specifically designed to provide positive overrange protection. Purged cover protects transmitter from weather, dust, and fumes.

You can install d/p Cells anywhere — in any position — simply and conveniently, and know they'll give unequaled accuracy and performance. Ask your Foxboro Field Engineer for complete details, or write for Bulletin 13-11A. **The Foxboro Company, 609 Norfolk Street, Foxboro, Mass.**

Foxboro d/p Cells for flow, liquid level, and other variables

- for high-speed flow measurement and control
- for flow measurement as small as 0.03 gpm
- for flow under static pressures to 6000 psi
- for use where elevated or suppressed ranges are required
- for electronic flow control systems
- for liquid level
- for comparison of process and sample fluids
- for absolute pressure measurement

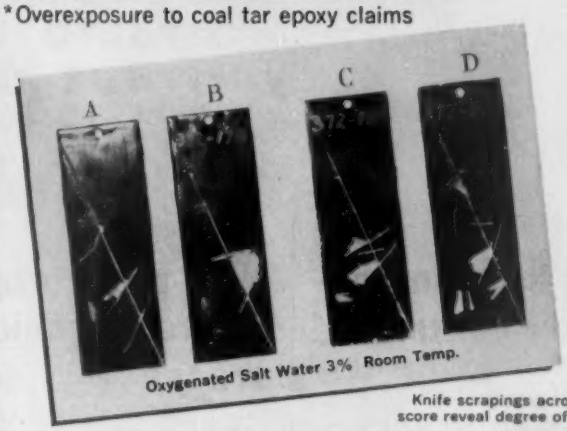
*Reg. U. S. Pat. Off.

Three fully adjustable ranges:
0-5 to 0-25 inches of water
0-20 to 0-250 inches of water
0-200 to 0-850 inches of water
Working pressures of 500, 1500, and 6000 psi

FOXBORO
REG. U.S. PAT. OFF.

SUFFERING FROM COALTAREPOXICATION?*

*Overexposure to coal tar epoxy claims



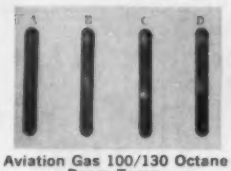
Knife scrapings across diagonal score reveal degree of undercutting.

Caustic Soda 5% Room Temp.

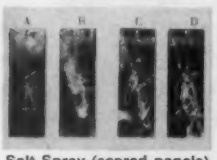
Sulfuric Acid 10% Room Temp.

Sulfuric Acid 30% Room Temp.

Sodium Hypochlorite 5% Room Temp.

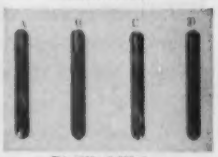


Aviation Gas 100/130 Octane Room Temp.

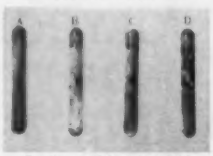


Salt Spray (scored panels) Room Temp.

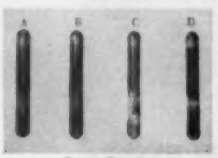
Distilled Water 140°F



Distilled Water Boiling

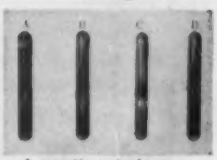


Sodium Chloride 20% Boiling



Sour Crude 120°F

JP-4 Jet Fuel 120°F



Aromatic petroleum hydrocarbon solvent—120°F

Try these tests to end the confusion

116

So many conflicting claims have been made about virtually every coal tar epoxy coating on the market that prospective users are finding it difficult to fish out the facts from a sea of superlatives.

Perhaps you can find *your* answer by duplicating any or all of these laboratory tests comparing the four leading coal tar epoxies.

THE TESTS: The rods and panels illustrated here were carefully coated to the four manufacturers' specifications and then subjected for three months to the corrosive agents indicated above. The wide range of tests included varying concentrations of chemicals, ambient and elevated temperatures, weathering and all usual types of exposure.

THE RESULTS: Some results were predictable, such as the failure of all four coatings to withstand aromatic petroleum hydrocarbon solvent. But striking differences occurred in such tests as oxygenated salt water, when only Coating A (Amercoat No. 78) resisted undercutting. Products B, C and D were all blistered and undercut to varying degrees. In none of the remaining tests was Amercoat No. 78 excelled, and in most cases it showed marked superiority.

CONFIRMATION: The properties attributed to No. 78 in these tests have been substantiated repeatedly in actual field use. Applicators like it because it (1) gives dependable, all-around protection, (2) sprays more easily than competitive products, (3) builds thick films without difficulty because of its higher solids content, and (4) dries thoroughly but at a moderate rate, avoiding the extremes of prolonged tackiness and fast-dried brittleness.

Because of the unusual importance of these tests to prospective users of coal tar epoxy coatings, we have prepared illustrated copies of the complete report. Write for yours today!

(Amercoat No. 78 was formerly designated No. 1686)

Amercoat® CORPORATION

Dept. CI
4809 Firestone Boulevard
South Gate, California

921 Pitner Ave. Evanston, Ill. 360 Carnegie Ave. Kenilworth, N.J 2404 Dennis St. Jacksonville, Fla. 6530 Supply Row Houston, Texas

Fast help on corrosion control

–A big Texas natural gas plant required periodic analyses to determine whether MEA solution was breaking down in regeneration, forming corrosive salts. Samples were being sent out of state for analysis, "took forever" to get results. Enter Allied. Now tests are run in Dallas, results come back *fast*, help this plant prevent corrosion before it can start.

New plant start-up trouble quickly traced–Slug of distillate filled inlet scrubber, carried over to amine system. Aqueous amine solution thoroughly contaminated with hydrocarbon. Customer shut down plant, was going to dump entire charge. Allied specialists diagnosed trouble as too rich amine concentration, then suggested decanting solution into empty tanks, which saved half of charge.

Foaming in glycol plant–Customer wanted to know what caused it, how to stop it. Allied specialists flew to the site, deduced cause of the trouble in a matter of hours. Lab analysis confirmed their findings. In a recommendation just five typewritten lines long, they told customer how to solve the problem completely, economically.

USE GLYCOLS OR AMINES?

ALLIED technical service is ready–right now–to help you find straight answers to knotty problems

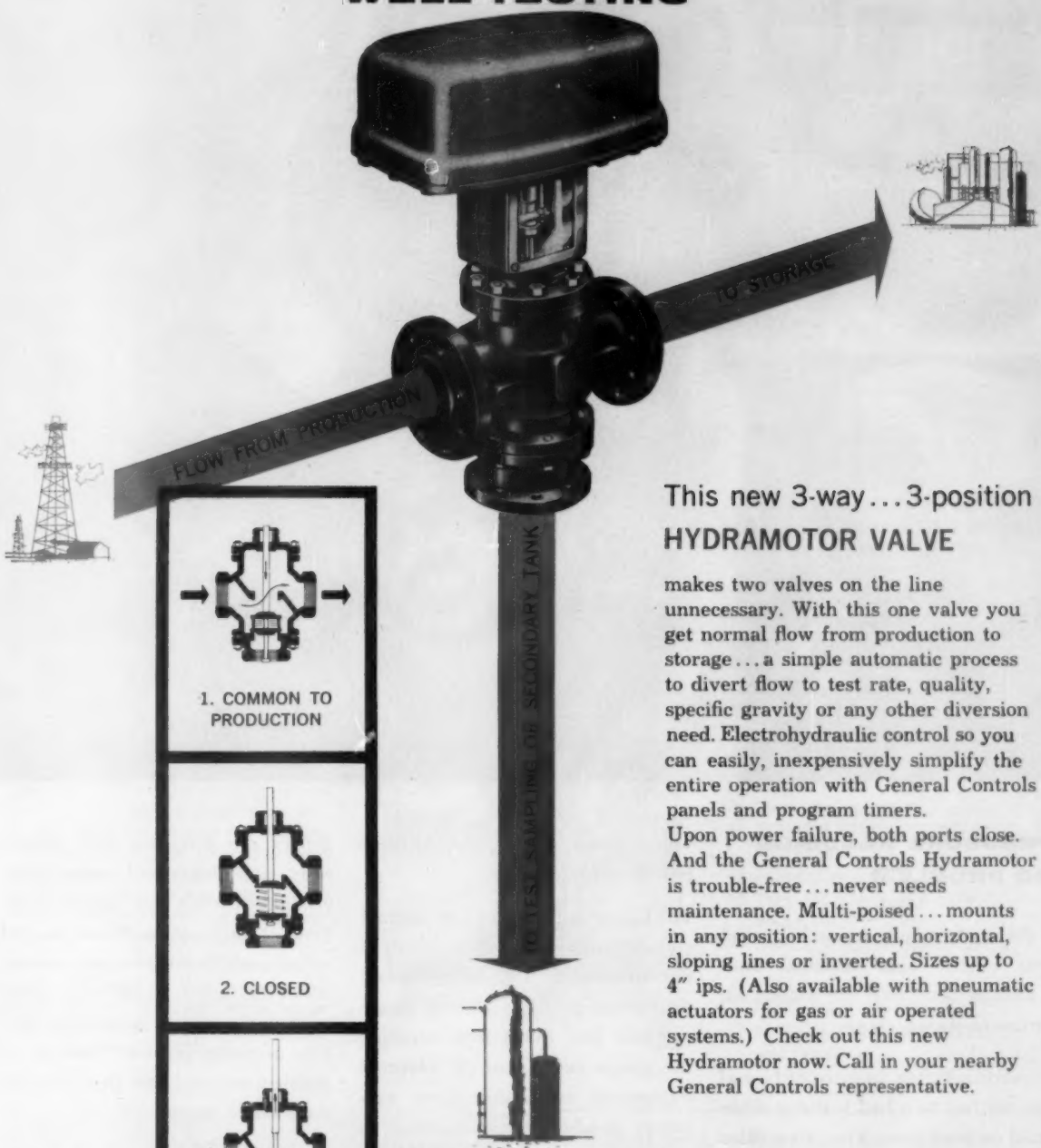
BASIC TO AMERICA'S PROGRESS

Allied Chemical

NITROGEN DIVISION
Dept. GA5-55-1, 40 Rector Street, New York 6, N. Y.

2819

NOW-
ONLY ONE ELECTRIC VALVE
NEEDED FOR AUTOMATIC WELL TESTING



This new 3-way... 3-position
HYDRAMOTOR VALVE

makes two valves on the line unnecessary. With this one valve you get normal flow from production to storage... a simple automatic process to divert flow to test rate, quality, specific gravity or any other diversion need. Electrohydraulic control so you can easily, inexpensively simplify the entire operation with General Controls panels and program timers.
Upon power failure, both ports close. And the General Controls Hydramotor is trouble-free... never needs maintenance. Multi-poised... mounts in any position: vertical, horizontal, sloping lines or inverted. Sizes up to 4" ips. (Also available with pneumatic actuators for gas or air operated systems.) Check out this new Hydramotor now. Call in your nearby General Controls representative.

GENERAL CONTROLS

Automatic Controls for Product or Process

Glendale, Calif. • Skokie, Ill. • Guelph, Ontario, Canada

Eight Plants—42 factory branch offices serving the United States and Canada

PRESSURE READINGS NO PROBLEM

Pulsating pressure in drilling mud was mighty hard to read until Cameron developed the unique instrument shown above.

Bourdon tubes in conventional gauges had two bad features when used on mud lines. First, they filled with line material (mud, sand, emulsions, etc.), and second, when operable they fluctuated violently as they reflected pump action.

This situation was not only difficult but dangerous.

The Cameron gauge with its original and exclusive design changed all of this overnight. The self-contained diaphragm of the Cameron gauge prevents line fluids from entering the gauge mechanism. A foolproof dampening mechanism gives uniformly steady pressure readings in spite of fast line fluctuations. Standard models are available for almost any service, including corrosives.

For offshore work, Cameron pressure gauges are furnished with bronze cases — an illuminated model makes visibility perfect for critical locations. With Cameron Flex-Seal mud valves and Shear-Relief valves they offer the safest, most economical control of mud systems available. For accurate pressure reading of problem materials, try these rugged, dependable gauges.

Cameron

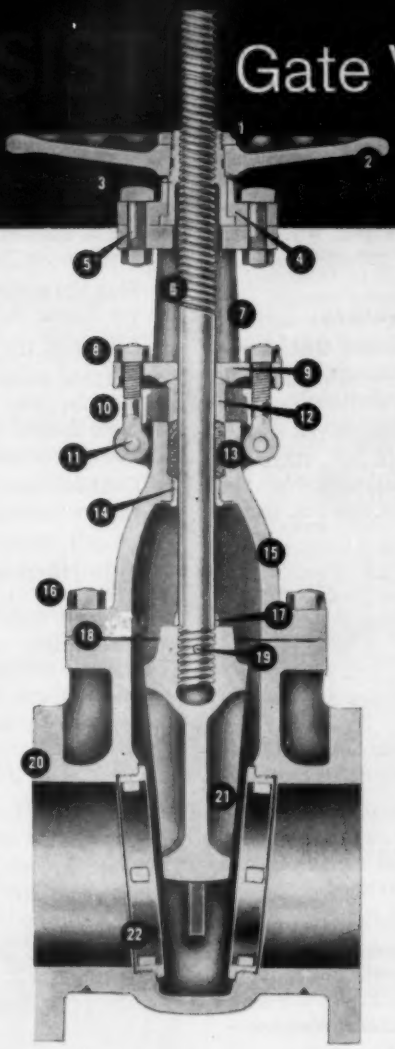
IRON WORKS, INC.

P. O. Box 1212 — Houston, Texas

Export Office: 7912 Empire State Bldg., New York City. In England: Cameron Iron Works Ltd., 76 Grosvenor St., London W. 1 England.

You extend valve life in Corrosive and Erosive services TWO WAYS when you

Specify for Gate Valves, too



No. 1 ... when you specify "Jenkins" you get not merely "Ni-Resist" metal but you get Type 2 Ni-Resist Cast Iron! That affords extra resistance to acids, salt and alkaline solutions, sea water, brine and other corrosive and erosive fluids, vapors or gases. It is copper-free and will not contaminate or discolor the materials controlled.

Type 316 Stainless Steel is used for the wedge, spindle and other trimmings to give you a combination of metals which have remarkable ability to withstand destructive service.

No. 2 ... you get all the excellence which the Jenkins Diamond trademark has represented for nearly a century. The superior design and construction are visible here. Equally important superiorities which show up only in the records of long service and low maintenance are the close grain and high density of Jenkins castings ... the precision of Jenkins machining ... the rigid inspection and testing which every Diamond-marked valve undergoes.

It costs no more to buy Ni-Resist Gates made by Jenkins. And, it may cost much less to USE them. Write us, or ask your Jenkins Distributor for information folder No. 205.

1 Bronze yoke bushing nut
2 Handy grip iron wheel
3 Bronze yoke bushing
4 Iron yoke cap with zerk fitting for lubricating bushing
5 Steel yoke cap bolts and nuts
6 TYPE 316 STAINLESS STEEL spindle
7 NI-RESIST CAST IRON, TYPE 2, yoke
8 Bronze eye bolt nuts
9 Malleable iron gland flange
10 Steel gland eye bolts
11 Steel gland lug bolts and nuts
12 TYPE 316 STAINLESS STEEL gland
13 Teflon impregnated asbestos packing
14 TYPE 316 STAINLESS STEEL bonnet bushing
15 NI-RESIST CAST IRON, TYPE 2, bonnet
16 Steel bonnet bolts and nuts
17 TYPE 316 STAINLESS STEEL spindle ring
18 Asbestos gasket
19 TYPE 316 STAINLESS STEEL wedge pin
20 NI-RESIST CAST IRON, TYPE 2, through-port body
21 TYPE 316 STAINLESS STEEL solid I-beam wedge
22 TYPE 316 STAINLESS STEEL seat rings

JENKINS
LOOK FOR THE JENKINS DIAMOND
VALVES
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Send folder No. 205 describing Ni-Resist Gate Valves

Name & Title .....

Company .....

Address .....

A look at today . . . and a glimpse

Armour Chemicals for oil production

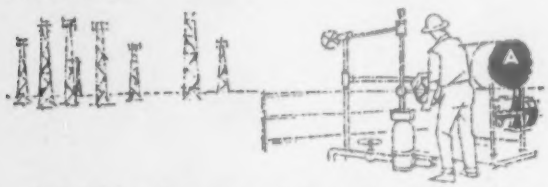
Where they work today

For many years, Armour aliphatic organic chemicals have solved numerous problems in the production of petroleum. That's why you'll find them at work where injection waters are being treated, when HCl is being inhibited, or where water coning problems are being studied.

Treating injection waters

Today there is ever-increasing evidence that shows corrosion inhibitors *alone* are not enough to control corrosion in water flood operations effectively.

A variety of field applications confirm the theory that bactericides are needed, too. In fact, there are many indications of a direct correlation between the presence of sulfate-reducing bacteria and the degree of corrosion.



In brief, here's some new information obtained from a report presented at an A.P.I. committee meeting.

(*a*) By injecting only small quantities of a bactericide into a system known to contain sulfate-reducing bacteria, 80% protection against corrosion was obtained. No other inhibitor was used.

(*b*) Most sulfate-reducing bacteria are known to multiply at an accelerated rate when temperatures increase. Actual tests show bacteria multiply 10 times faster at 95°F than at 77°F. As a result, when temperatures increase, bacteria increase—and so does the rate of corrosion.

In fact, the report shows the rate of corrosion jumps about 100 times with 130°F increase in temperature.

The above information was further substantiated by field tests.

In a cooperative test on an East Texas flood, one of Armour's organic chemicals—a combination inhibitor/bactericide—reduced the corrosion from 68 MPY to 1 MPY.

At the same time, all sulfate-reducing bacteria were brought completely under control.

And this protection was accomplished at a cost of less than 1 mil per barrel of injected water!

Here is what Armour recommended as a treatment procedure for "seasoning" a typical system.

- Slug the system with 40-50 ppm bactericide/inhibitor (basis: fluid injected) for about 3 days.
- Cut back the concentration to 25 ppm for 7 days.
- Further reduce the concentration to about 10 to 15 ppm after a bacterial analysis has verified complete control of bacteria and effective reduction in the rate of corrosion.
- Continue periodic sampling and analysis to assure the treatment continues to be effective.

Armour's Petroleum Section is aware that certain field conditions may interfere with the initial slug treatment with a bactericide/inhibitor. Therefore, we suggest that you talk to your Armour representative regarding your specific treatment problems. He can give you recommendations for your special water flood situation.

Check "A" in the coupon for complete information.

New HCl Inhibitor

Armour's new hydrochloric acid inhibitor—Armohib® 28—is now available to the petroleum industry.

This fatty-nitrogen-derived chemical is of special value when HCl is used to remove harmful deposits or scale during the fracturing or acidizing of oil wells.

As little as 0.25% of Armohib 28 enables you to use a 10-15% HCl solution and get 99.8% protection against pitting and corrosion. The cost? Only $0.0125 per gallon of acid.

In addition, this new inhibitor is completely safe to use. It produces no harmful side effects to reservoirs or fluids.

15% HCl solution on mild steel for 6 hours at 200°F

% Armohib 28	Corrosion Rate lbs/ft²/day	% Protection	Cost per Gallon of Acid	Visual Appearance
(Control)	7.9	—	—	Disappeared in 4 hours
0.10	0.0310	99.6	$0.005	Bright, No Pitting
0.15	0.0260	99.7	0.007	Bright, No Pitting
0.25	0.0190	99.8	0.012	Bright, No Pitting

# of tomorrow

from Armour Chemical

Further testing of Armohib 28 at 265°F has also produced excellent corrosion protection on mild steel.

Here are some additional advantages of Armohib 28:

- It effectively controls corrosion of 316 stainless steel, monel, bronze and mild steel.
- It is effective over a wide temperature range.
- It's non-staining. Will not deposit a waxy surface film on treated metal; leaves the surface clean and bright.
- It will not precipitate in the presence of ferric ions.

For more protection against HCl corrosion at less cost, put Armohib 28 to work in your acid treatments.

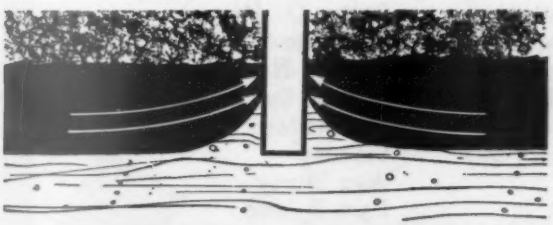
For more data, check "B" in coupon.

Where Armour Chemicals will work tomorrow

Solving the Water Coning problem

Laboratory data and field tests indicate that certain Armour water-soluble cationic chemicals—when introduced into the coned area of a producing well—will considerably reduce the water/oil ratio.

These findings were recently substantiated in a test on one well of a two-well field producing into a common tank battery. During the test, *oil production* was increased from 200 to 390 barrels per month!



The treatment consisted of solubilizing 40 to 50 gallons of the proper Armour surfactant in a 210-barrel tank of produced water. The water was then slowly pumped into the well to be treated, followed by a quantity of untreated water to displace all the treated fluid from the annulus into the cone.

This approach is based on work done by Dr. Alan S. Michaels of M. I. T.

Admittedly, additional research and field tests are needed. Armour Chemical is continuing more test programs in cooperation with several producers.

Check "C" in coupon for more complete information.

If you have problems in oil production, contact Armour. As the leading producer of organic chemical corrosion inhibitors/bactericides, we are qualified to help you determine the right chemical for your special situation. Send the coupon. Or better yet—call us today!

NEWS NOTES

Washington, D. C. Patent #2,733,206 recently issued to Armour and Company covers water flood treatment with dicoco dimethyl ammonium chlorides, or with compounds containing this chemical. Included in the patent claims are inhibition of bacteria, prevention of corrosion, and decreasing of interfacial tension between oil and water phases.

Kansas. Cost figures from a water injection system in this state, just released, show an Armour corrosion inihibitor/bactericide saved the operator almost $66,000.00. Total cost of the chemical was only $2,500!

Illinois Basin. 2½ gallons of an Armour Chemical recently increased the water intake of an injection well here from 19 to 35 barrels of water per day. After 3 weeks, with no further treatment, the well still was able to take 31 BWPD!

Texas. During a recent field test, one of Armour's polar organic compounds proved to be the only product to foam oil effectively. It is believed this chemical will prove to be very valuable in wet-gas wells which have built up a liquid head great enough to kill the well.

Leader in Progressive Fatty Acid Chemistry

Armour Industrial Chemical Company

A Division of Armour and Company

Armour Chemicals can save you money

Check here for more information on your field of interest.

☐ A ☐ B ☐ C

Send samples and more information for this application:

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CITY_____ STATE_____

OGJ-9-59

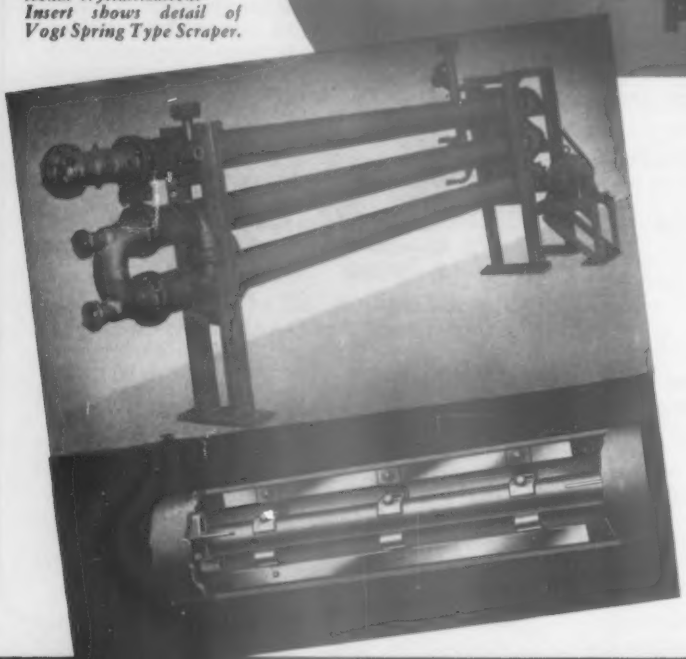
Armour Industrial Chemical Company
110 North Wacker Drive • Chicago 6, Ill.

Vogt

SCRAPED SURFACE EXCHANGERS

Solve those Special Heat Transfer and Crystallization Problems . . .

BELOW: *A scraped surface unit for production of Para-Xylene by fractional crystallization. Insert shows detail of Vogt Spring Type Scraper.*



. . . *And Here's How:*

1. Rotating scraper action continuously sweeps surfaces clean even while processing highly adhesive materials.
2. Uniform rate of heat transfer keeps crystallization under control and discharges crystals as a slurry.
3. Product is thoroughly mixed by scraper blades as it flows.
4. Closed, pressure-type system permits use of flammable, volatile and expensive solvents with complete safety and no solvent loss.
5. Units fabricated from a broad range of materials to suit process stream characteristics.

Write for Literature. Address Dept. 24A-XO

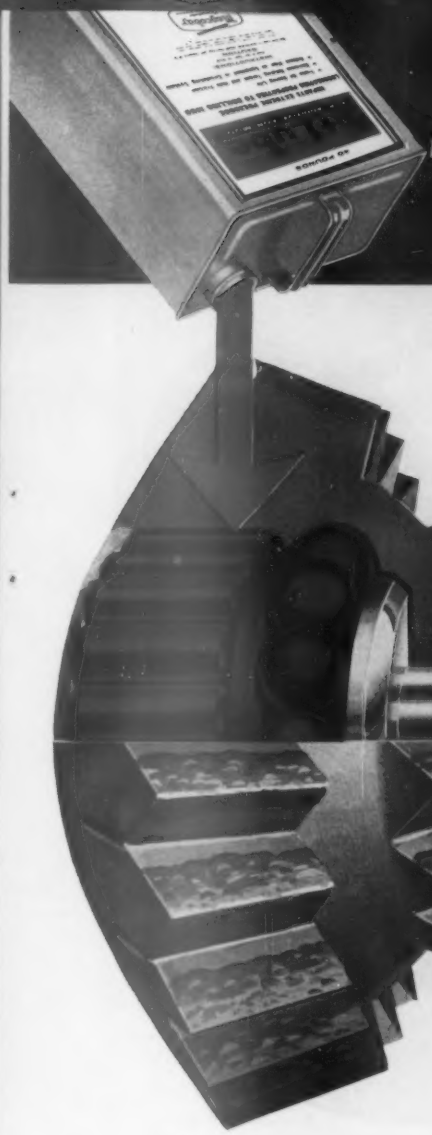
Listed here is a wide variety of materials which have been successfully processed with Vogt Scraped Surface Exchangers in the chemical, petro-chemical, petroleum and related industries.

Benzene Hexachloride
Caustic Soda
Caustic Potash
Clay
Cylinder Stock
Para-Dichlorbenzene
Fatty Acid Solutions
Fish Oil
Linseed Oil
Naphthalene
Paratone & Solids
Phenolic Resins
Polyester Liquid
Pressed Distillate
Reduced Petroleum
Waxy Oil-Solvent Mix
Soybean Oil
Sperm Oil
Sugar Syrup
Sulfur-Oil Mix
Sulphate Solution
Tall Oil-Naphtha-Sulfuric Acid Solutions
Tetrachloro Benzene
Viscose
Wax Slurry
Para-Xylene

Vogt FOR BETTER HEAT TRANSFER EQUIPMENT

HENRY VOGT MACHINE CO.
Louisville 10, Ky.

SALES OFFICES
New York, Chicago, Cleveland, Dallas, Camden, N. J., St. Louis, Charleston, W. Va., Cincinnati



HOW BIT LUBE AND MAGCOBAR ENGINEERING CUT DRILLING COSTS

In a West Texas Well, Magcobar Engineers put a film here to make net savings of $4.87 per foot

	NO. BITS	BIT SIZE	INTERVAL	ROTATING HOURS	WEIGHT ON BIT	RPM
BIT LUBE-WATER	28	7⅞"	4919-7272	185	70-90,000	60-80
WATER	48	7⅞"	4936-7270	379	45-60,000	55-60

You are always sure of getting every cost-cutting advantage with Magcobar. Here's why: The Magcobar Mud Engineer combines a thorough knowledge of drilling fluid chemistry with experience in your drilling area. This background—plus the top mud lab in the country—gives new dimension to the finest and most complete line of drilling mud products. What does this mean to you? The highest level of product performance to cut your drilling costs.

Here's proof of actual savings using Bit Lube (E. P. Additive for Mud). The table shows a drilling cost comparison in the Brownfield, Texas, area. The Bit Lube well was drilled for $4.87 per foot less than the offset well. Total savings in bits, trips, and drilling was $13,420. Bit Lube and emulsifiers cost $1,940; a net saving of $11,480!

Bit Lube forms a tough protective film to reduce friction and to increase bit bearing life under extreme pressure conditions. It works best with high weight on the bit and fast rotary speed. Bit Lube and Magcobar engineering may be the answer to your bearing failures.

Bit Lube is only one of Magcobar's many answers to the problem of high drilling cost, a problem that demands the right answers. You'll find that the right products *used right* by Magcobar can cut costs on your next well, too.

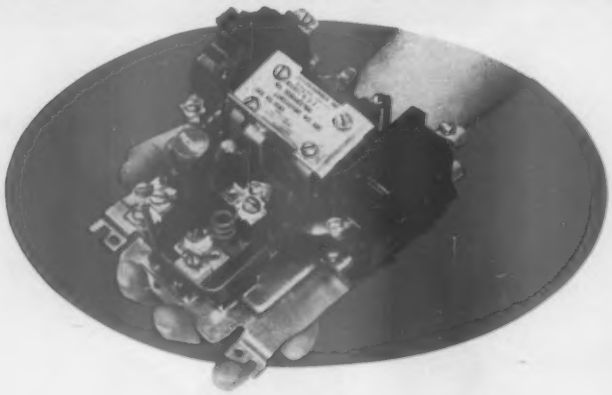
MAGNET COVE BARIUM CORPORATION
HOUSTON, TEXAS

Magcobar
Complete
DRILLING MUD SERVICE

Another Well Done *with Magcobar Technology!*

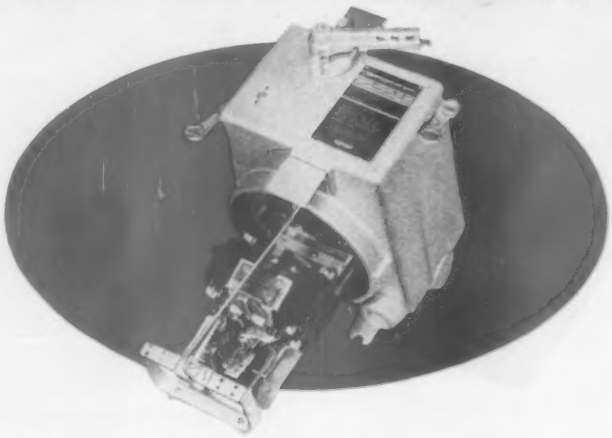
Nothing left to chance...

CUTLER-HAMMER MOTOR CONTROL



in

CROUSE-HINDS EPC CONDULETS®



for

HAZARDOUS LOCATIONS

When conditions dictate the use of explosion proof motor control, experienced oil men leave nothing to chance . . . they install dependable Cutler-Hammer Three-Star Motor Control in super-safe Crouse-Hinds EPC Condulets.

Crouse-Hinds cast aluminum enclosures are easy to install. Non-binding threads between the caps and body facilitate installation and inspection. Unitized control panels are removable by two screws, providing maximum wire-pulling freedom. Straight-through control wiring to clearly marked terminals eliminates accidental wiring errors.

Cutler-Hammer Three-Star Motor Control works better, lasts longer. Tests prove super-life vertical contacts out-perform all others never requiring time or attention in 90% of its uses. Adjustable overload relays are accurate to within 3% of full load motor current instead of the usual 10% or 12% . . . motors work at rated capacity without nuisance tripping. And 3-coil overload relays fit the standard enclosures providing full three-phase overload protection.

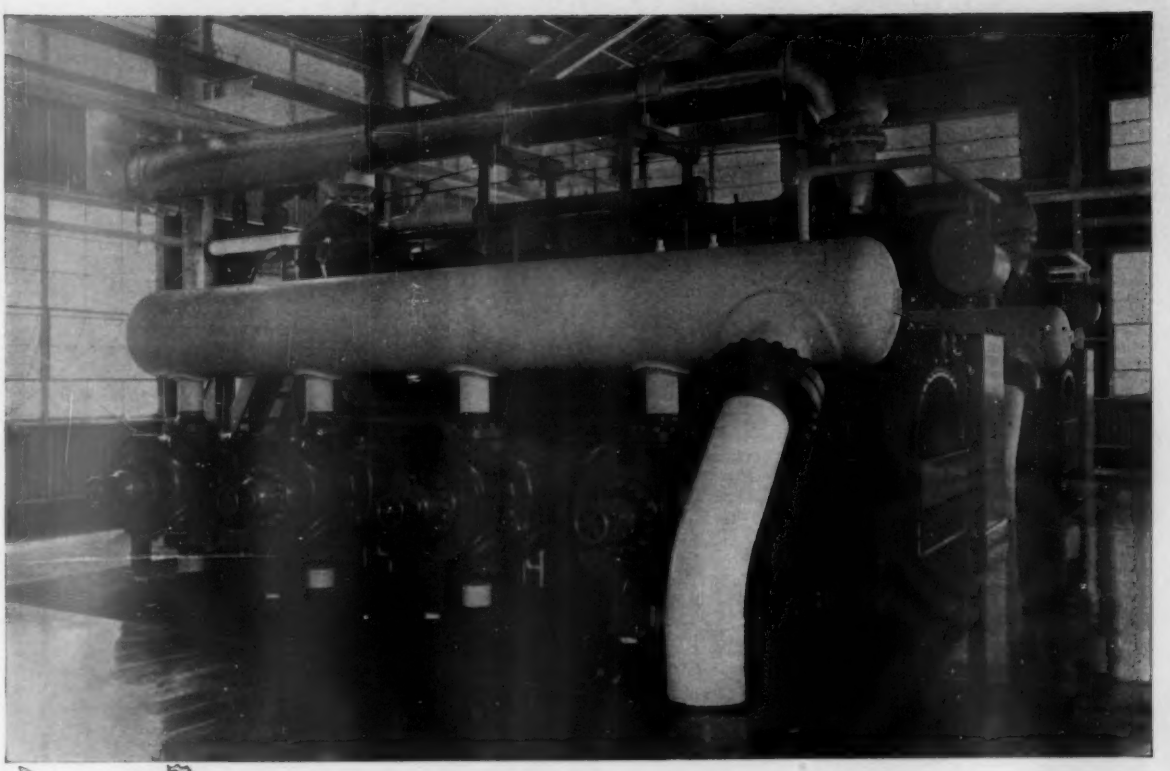
Safe, dependable performance is assured when you use Cutler-Hammer Motor Control for all your requirements. Now available in combination starters, NEMA size 0 through 4. See your authorized Cutler-Hammer Distributor today. Cutler-Hammer Inc., Milwaukee 1, Wisconsin.

CUTLER-HAMMER CONTROL

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wis. • *Division:* **Airborne Instruments Laboratory.** • *Subsidiary:* **Cutler-Hammer International, C. A.**

Associates: Canadian Cutler-Hammer, Ltd.: Cutler-Hammer Mexicana, S. A.: Intercontinental Electronics Corporation.



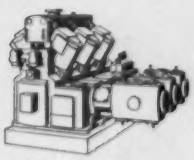
which comes first...

the ENGINE or the COMPRESSOR?

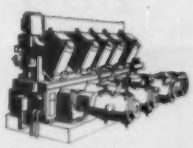
Of course, the power end of a gas-engine compressor is important. The engine cylinders must be capable of delivering smooth power in continuous operation, month after month, with efficiency and economy. And no engine can show better records of long run reliability and sustained efficiency than the Ingersoll-Rand 4-cycle V-angle design. The smooth running characteristics of the I-R 4-cycle engine are well-known.

But don't forget the compressor end; after all, that's what you've really bought—a compressor! The sustained compression efficiency and freedom from maintenance troubles are what make the difference. Ingersoll-Rand has the world's most comprehensive compressor experience, and builds the widest line of units to suit the exact requirements of any application.

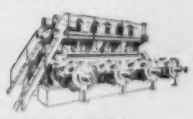
One of the major differences between I-R and other compressors is the valving. I-R Channel Valves are known around the world for efficiency, quietness, and almost unbelievable durability. Each valve is a combination of rigid stainless-steel channels and bowed leaf springs, with trapped-air spaces which cushion action and prevent impact. The separate stainless-steel seat plate can be reversed for double life or replaced, using only simple tools; the I-R Channel Valve is the only compressor valve that can be completely reconditioned in the field without machining. And only Ingersoll-Rand compressors have genuine Channel Valves.



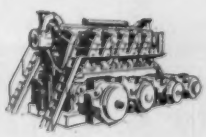
JVG 120-240 hp



SVG 330-660 hp



KVG 660-1320 hp



KVS 1000-2000 hp

ALSO
KVT 3000-4000 hp

4-CYCLE

Ingersoll-Rand

6-953

11 Broadway, New York 4, N.Y.

COMPRESSORS • GAS & DIESEL ENGINES • PUMPS • AIR & ELECTRIC TOOLS • CONDENSERS • VACUUM EQUIPMENT • ROCK DRILLS

A LETTER FROM SOHIO TO M. W. KELLOGG

"We are well pleased with the performance of this integrated unit. It has performed with fewer startup troubles than we had anticipated, and it has demonstrated considerably more operating flexibility than we had expected..."

(Signed) F. J. SANDERS, Engineering Manager
The Standard Oil Company (Ohio)
Cleveland, Ohio

The above is an excerpt from the letter of acceptance from The Standard Oil Company (Ohio) to The M. W. Kellogg Company for SOHIO's recently dedicated 60,000 BPSD refinery at Toledo. Kellogg is privileged to have been able to work with Dr. Sanders and the many others at SOHIO in making this highly integrated $40 million refinery an economic success. For those wishing to obtain the complete story on the project, write Kellogg for the SOHIO Kelloggram—a 20-page booklet devoted to the refinery's engineering, construction, and operation.

THE M. W. KELLOGG COMPANY, 711 THIRD AVENUE, NEW YORK 17, N. Y.
A SUBSIDIARY OF PULLMAN INCORPORATED

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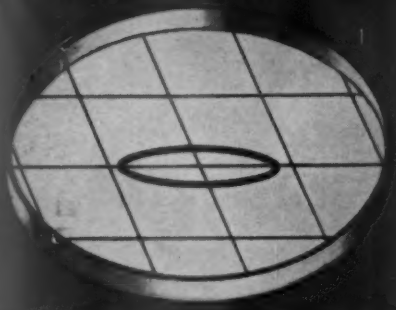
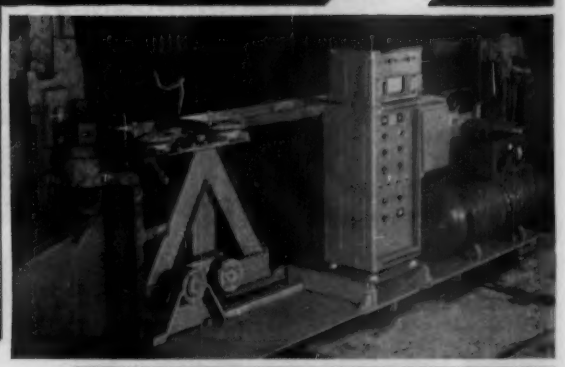


You saw it at the International Petroleum Exposition...

FARROWTEST

REPUBLIC'S
PROVED
PERFORMANCE
SAFEGUARD



Exclusive with Republic
Electric Resistance Weld Line Pipe

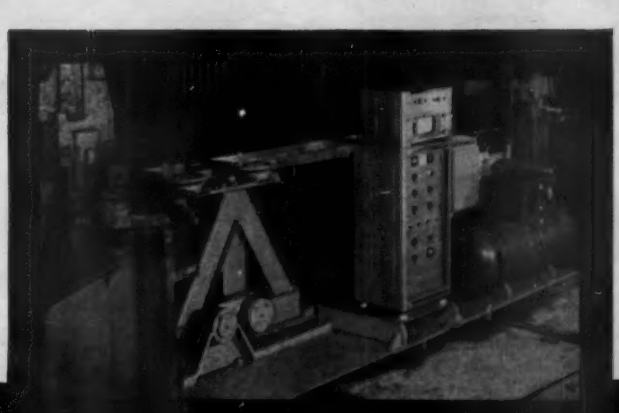
You saw it at the International Petroleum Exposition...

FARROWTEST

The unique inspection method that uncovers injurious defects frequently missed by other testing devices. The exclusive eddy-current test that assures top dependability. The first and only non-destructive test to offer quality you can measure!

FARROWTEST is a proved and established safeguard. It has been used by Republic with complete success in the production of hydraulic tubing, boiler tubes, and tubular products for other critical uses for years, as pictured above.

A PROVED PERFORMANCE SAFEGUARD— FARROWTEST's unlimited sensitivity can be calibrated to detect and reject harmful line pipe defects. Only pipe that meets established quality requirements will be delivered.



...for quality you can measure!

FARROWTEST®—Exclusive with Republic Electric Resistance Weld Line Pipe—will benefit *you*. Here is a process that uncovers hidden defects missed by other testing methods. It is the only non-destructive test that provides you with quality you can measure. It acts independently of the observation, judgment, or opinion of the operator.

It's a fact. FARROWTEST's unlimited sensitivity can be calibrated to detect and reject harmful line pipe defects. Unveiled by Republic at the International Petroleum Exposition, FARROWTEST amazed onlookers by detecting invisible yet critical defects in stainless and carbon steel samples.

FARROWTEST is a *proved* production safeguard. It has been used by Republic with complete success in the production of tubular products for other critical uses. Its application to line pipe production for scientific quality control follows years of comprehensive research and development. In its application to line pipe, FARROWTEST will not initially displace the conventional standard tests. Such tests will continue as supplementary tests.

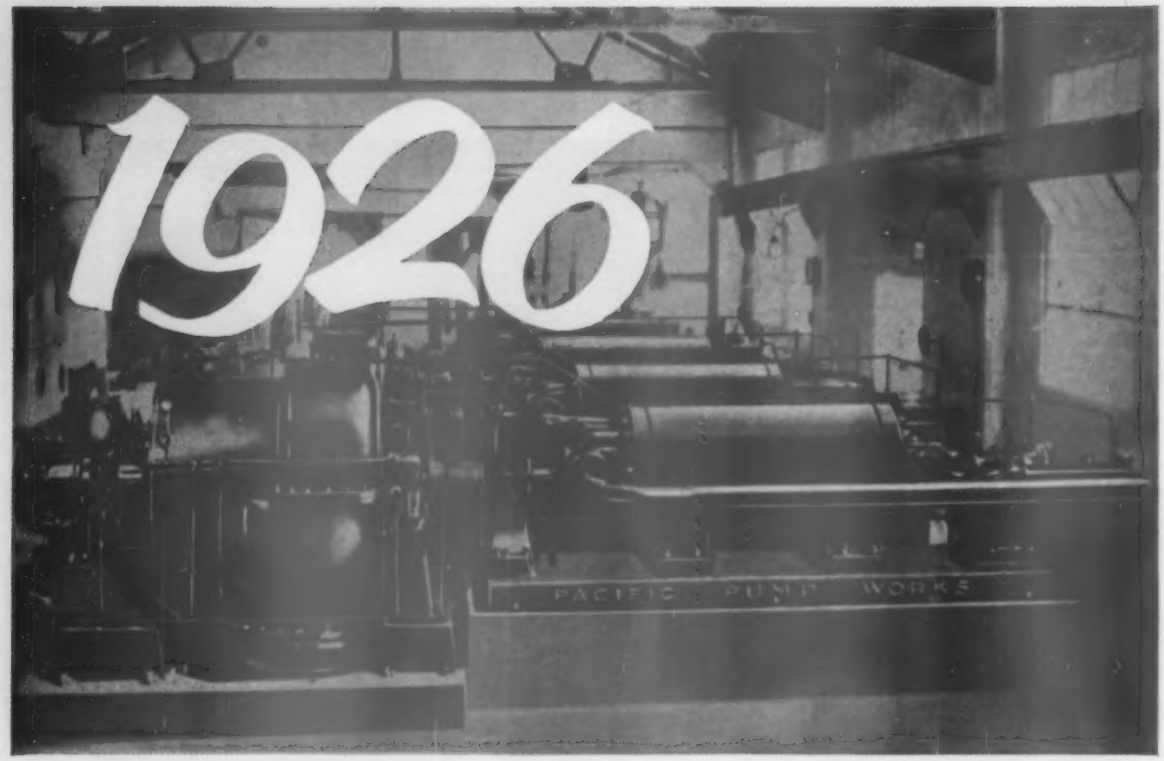
What it means to you is top dependability in the field. With FARROWTEST, only pipe that *meets* established quality requirements will be delivered. Utmost uniformity—a characteristic of Republic Electric Resistance Weld—remains unchanged. FARROWTEST is a non-destructive process. You will continue to enjoy accurate line-up of joints, smooth bending in field or shop, uniformly high yield strength and ductility.

Learn more about FARROWTEST—the most important line pipe advance of the decade. Write Republic Steel Corporation, Dept. OG-7914, 1441 Republic Building, Cleveland 1, Ohio

REPUBLIC STEEL

CLEVELAND 1, OHIO

World's Widest Range of Standard Steels and Steel Products



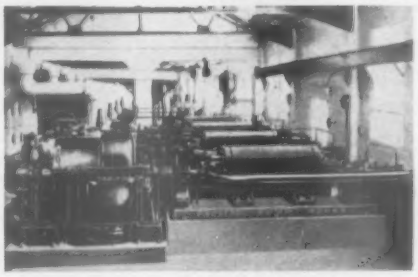
PACIFIC PUMPS

first "FIRST"

The centrifugal pumps designed and built for Pan American Oil Company's new high-pressure cracking process in 1926 was one of the most significant engineering achievements of the Twenties in the refinery processing field. The first of many Pacific Pumps' "FIRSTS", this particular pump was the forerunner of today's greatly improved Pacific centrifugal process pump line. Over the years Pacific has built and installed thousands of vertical and horizontal centrifugal pumps for extreme pressures and temperatures demanded by the petroleum, chemical, petro-chemical and allied industries. In addition, Pacific designs and manufactures boiler feed pumps for the power industry, steam turbo-pumps for the marine and power generation fields, and plunger pumps for oil-well service.

This first Pacific advertisement appeared in several petroleum publications early in 1927

2000 POUNDS PRESSURE WITH CENTRIFUGAL PUMPS



View of recent installation of four "PACIFIC" Multi-stage Pumps at Pan American Petroleum Company Refinery, Los Angeles. Each Pump delivers a capacity of 400 Gallons Per Minute of Oil against a pressure of 2000 pounds. Pumps are driven by 750 H. P. Steam Turbines. Each Pump weighs nine tons and was required to pass a hydrostatic test of 5000 pounds pressure.

We are prepared to make prompt shipment of Booster Pumps for Pipe Line or High Pressure service. Special Pumps designed for unusual conditions.

PACIFIC PUMP WORKS
350 Bicket Street Huntington Park Los Angeles, Cal.

Write for **Bulletin 1C**

PACIFIC

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PACIFIC PUMPS

Inc. . . A Division of Dresser Industries, Inc.

HUNTINGTON PARK, CALIFORNIA

IM-1

"FRANKLY HOPWOOD,

DON'T YOU THINK IT WOULD BE MUCH MORE PRACTICAL IF WE SENT FOR **BRIDGEPORT'S** FREE NEW BOOK— 'SOLVING CORROSION PROBLEMS IN INDUSTRY'!"

If you convey anything through condensers or heat exchangers, this 20-page Bridgeport book is must reading. It tells how to lick problems involving two corrosive media...by using bi-metal Duplex Tubes ...each metal surface designed to resist corrosion from the media to which it is exposed.

Each industry has its own corrosion problems, and this fact-packed book illustrates ways to solve many of them. For your personal copy, just write, on your company letterhead, to the Bridgeport Brass Company, Bridgeport 2, Connecticut. Please address Dept. 5705.

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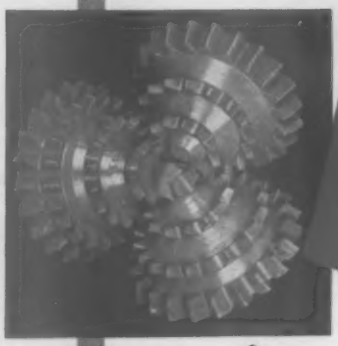


SECURITY makes the RIGHT BIT for the job!

For Hard Formation Drilling...

specify SECURITY "H" SERIES Bits

276 { TYPES, SIZES AND VARIATIONS

SECURITY makes a complete line of rock bits — more than 1120 types, sizes and variations. Of these, 276 are supplied exclusively for HARD FORMATION drilling.

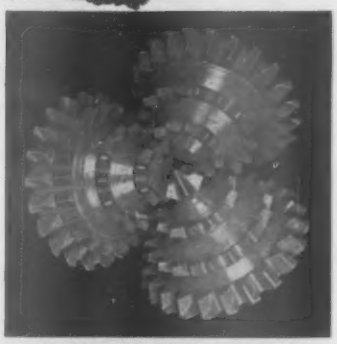
Like all Security bits, "H" SERIES *hard formation* rock bits can be obtained for either regular, jet, air, or jet-air circulation. Whatever your specific drilling requirements, specify Security and get the *right* bits for every well you drill. You will find — as thousands of others have — that Security rock bits lead in quality construction and modern design features, and are first choice for use under present-day drilling requirements.

Complete data about Security rock bits and drilling tools are contained in the 1959 catalog. Write today for your free copy.

H7

FORMATION RATINGS: For hard semi-abrasive sand, hard lime with chert streaks, dolomite, etc.

SIZES: 23 bit sizes from 5⅝ inches to 12¼ inches



H7L

FORMATION RATINGS: For hard-abrasive consolidated sandy limestone, chert-bearing limestone and dolomite, and other hard-abrasive strata.

SIZES: 6 bit sizes from 7⅞ inches to 12¼ inches

H7W

FORMATION RATINGS: For extremely hard and abrasive chert, schist, sand rock, quartzite, pyrite and granite.

SIZES: 23 bit sizes from 5⅝ inches to 12¼ inches

H9

FORMATION RATINGS: For very hard, brittle, extremely abrasive chert, flint, taconite, quartzite and basalt.

SIZES: 10 bit sizes from 6½ inches to 12¼ inches

Security

Slick as a Slide Rule!

New JOHN DEERE 5-Position BACKHOE

Shifts Boom in 15 Minutes!

Finished that job of flush digging already? To change the boom mounting for a different job with the John Deere 51 Backhoe, here's all that's required: Just drop the bucket to the opposite side, remove four bolts and *slide* the boom mounting wherever you want it on the pad . . . using the boom's own hydraulic power. All hydraulic connections stay intact. At the outside, it's a 15-minute job for one man, using only a wrench.

For transport, leave the boom mounted at left or right. Boom then folds snug up against pad to make a superbly compact and well-balanced unit for the road. Ask your John Deere dealer for a demonstration.

Some "51" Features

- ★ Simple 2-lever control speeds digging.
- ★ Great new breakout power for hard digging.
- ★ Ground-level reach—20 feet, 9 inches; working depth—13 feet, 6 inches; dumping height—11 feet; boom travel—180 degrees.
- ★ Backhoe can be removed from tractor in five minutes.

JOHN DEERE Industrial Tractors and Equipment

The center-mounted John Deere 50 Backhoe has 205-degree boom swing. In tight spots, digs at 90-degree angles to tractor.

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Please send detailed information on John Deere Industrial Tractors with new ☐ 5-Position ☐ Center-Mounted Backhoe ☐ Other Equipment for Builders and Contractors.

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GUIBERSON DRILL PIPE PROTECTOR RUBBERS

Stay Put.. Keep Their Grip.. Keep Their Size..

Guiberson drill pipe protector rubbers show their quality when we first put them on your pipe. And in the hole, they *stay put*. They can work in high temperatures or in oil base drilling muds— take a powerful amount of wear and abuse. *They keep their grip.*

You get extra casing protection and extra performance from Guiberson protector rubbers because they're made from a special wear-resisting rubber compound, designed for universal application in all kinds of drilling. And you get it because Guiberson just plain *knows how* to mold and compound rubber products that can take the tough jobs in today's wells — and lick them.

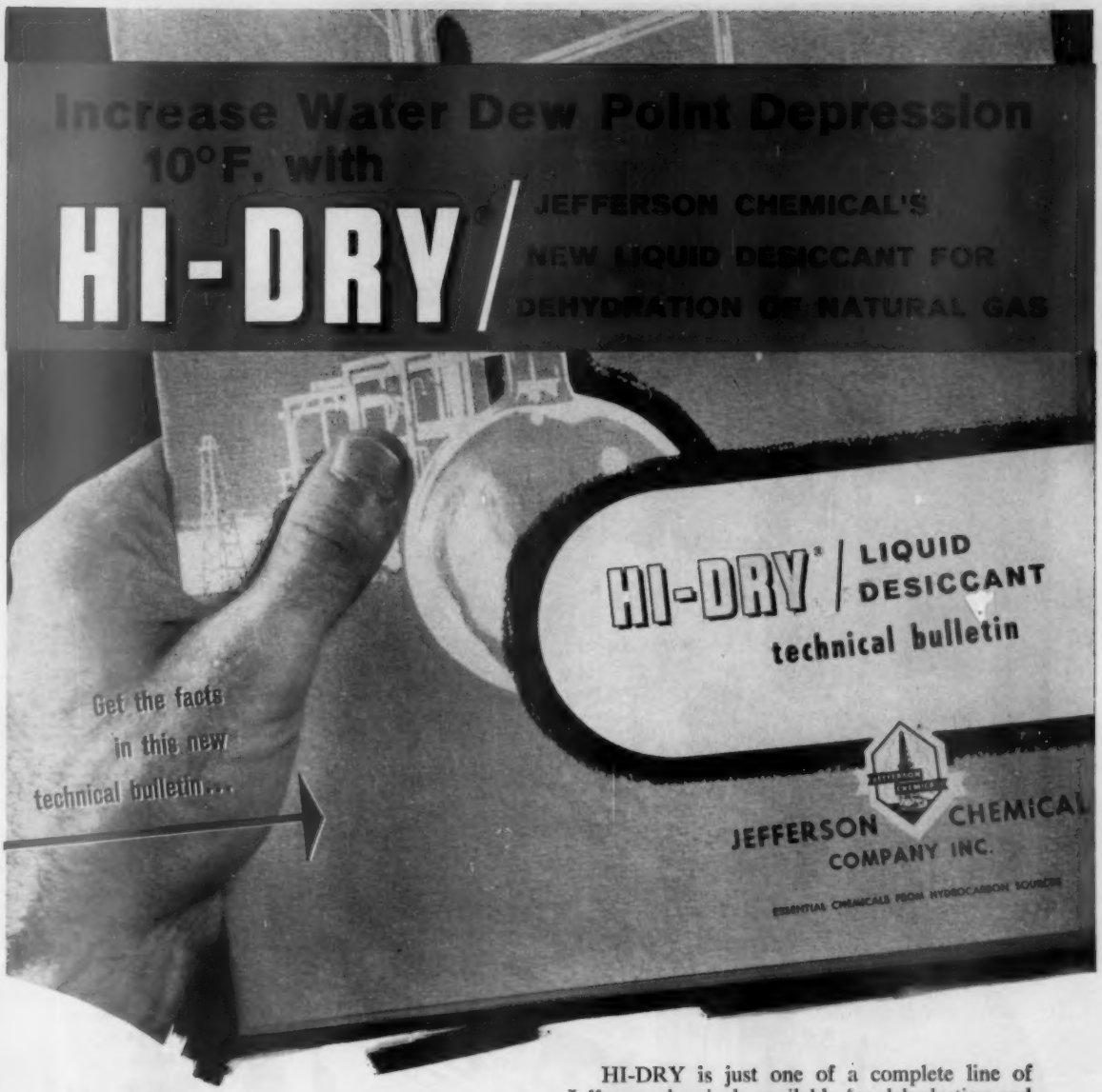
That extra rubber know-how comes from Guiberson's long years of experience in manufacturing rubber products specifically for the oil industry. It comes from a rubber plant and laboratory staffed and equipped to do the specialized job right. When you want drill pipe protectors that won't walk and do maintain their original OD for a long, useful life, look to Guiberson for the answer.

SAFE THAN SORRY BETTER BE GUIBERSON

THE GUIBERSON CORPORATION

ESTABLISHED 1919 DALLAS, TEXAS U. S. A.

Sold by Oil Field Supply Stores Everywhere



HI-DRY® brand liquid desiccant is a tetraethylene glycol concentrate developed specifically to give you the extra dew point depression so often needed in the dehydration of natural gas. Extensive field tests indicate that reconcentration of HI-DRY at 435°F. and triethylene glycol at 375°F. are comparable in level of thermal stability. The lower vapor pressure of HI-DRY, in addition to the increased degree of reconcentration achievable due to its greater thermal stability, offers an advantage in the dehydration of higher temperature gas streams such as those experienced at compressor stations.

Provided in this new HI-DRY technical bulletin are sales specifications, shipping information, typical applications and physical properties. From the physical properties you may readily estimate the results obtainable with various operating conditions.

HI-DRY is just one of a complete line of Jefferson chemicals available for dehydration and sweetening. Jefferson's extensive background of experience in gas treating processes is at your disposal. For helpful technical services, samples of HI-DRY liquid desiccant, or the new HI-DRY technical bulletin . . . contact Jefferson Chemical Company, Inc., 1121 Walker Avenue, P. O. Box 303, Houston 1, Texas.

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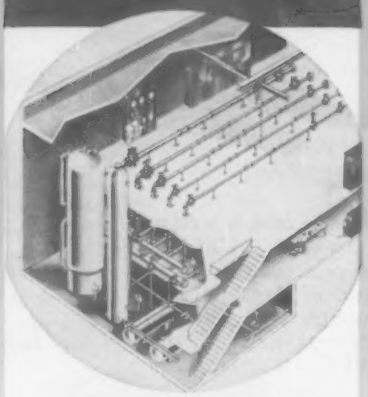
Essential Chemicals From Hydrocarbon Sources

The largest laboratory of

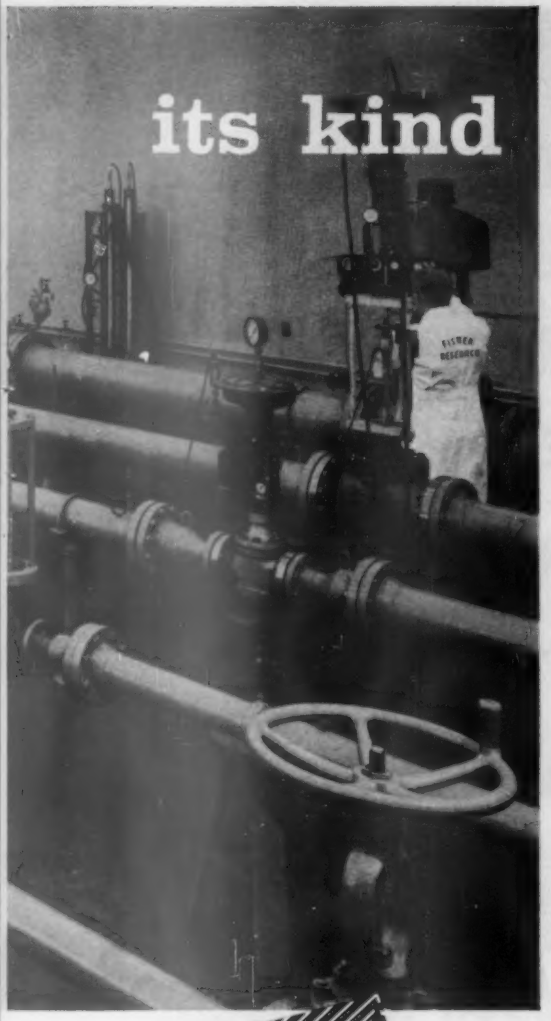
Flowmeters and manometers are just two types of precision equipment used for accurate measurement in this unique laboratory.



Three full stories are devoted to testing and proving the quality of all Fisher equipment.

A Fisher engineer obtaining frequency response data of Fisher equipment under test on an oscillograph.

IF IT FLOWS THROUGH PIPE ANYWHERE IN THE WORLD... CHANCES ARE IT'S CONTROLLED BY...



its kind in the world

where research engineers develop and perfect the quality of Fisher products

THIS is a remarkable facility. It's the nerve center of a 3-story laboratory built to duplicate every conceivable field condition under which any Fisher product might operate. There's no other like it, anywhere. The engineers shown are keeping keen observation on the operating characteristics of such Fisher equipment as pressure regulators, liquid level controls, diaphragm control valves . . . plus many other types. There are literally hundreds of these complex and abnormally rigid tests which Fisher controls are subjected to before they are released to the user.

QUICK FACTS ABOUT THE FISHER LABORATORY

- It is equipped with vessels capable of storage pressures up to 2500 psig. These vessels discharge into five flow metering lines ranging in size from 4 inches to 12 inches.
- It is possible to test with either air or water at 400 psig pressure. One 4-inch line is capable of 2500 psig pressure for air or water testing.
- All flows are metered with orifice plates and differential manometers. Liquid flows can be metered up to 6000 GPM and gas flows up to 7,000,000 SCFH.
- Actual flow test curves are recorded on each Fisher valve design. This gives a visual record of the operating characteristics of each piece of Fisher equipment and proves that its performance in the line will precisely match published data.
- It is an approved laboratory for determining official ASME capacity ratings on safety and relief valves used on unfired pressure vessels.

The end result of these combined facilities and constant vigilance is the building and maintenance of user confidence . . . so that when an instrument man says "put a Fisher in the line" he knows that it will perform as promised and guaranteed.

Send for Bulletin AL-8

This comprehensive booklet contains valve sizing and capacity charts obtained from thousands of actual laboratory flow tests for all Fisher body types and inner valve styles.

FISHER GOVERNOR COMPANY

Marshalltown, Iowa / Woodstock, Ontario / London, England

BUTTERFLY VALVE DIVISION: CONTINENTAL EQUIPMENT CO., CORAOPOLIS, PENNSYLVANIA

FISHER® Controls

SINCE 1880

OIL INDUSTRY'S NEWEST MONEY MAKER *

HAMONDFLOTE COVE

HAMONDFLOTE COVER

the practical—economical—guaranteed

FLOATING ROOF

for small diameter tanks used in marketing, bulk storage, producing and processing operations.

Write today for Bulletin 59HC.

* EARNS $775 per tank per year on $450 investment

HAMONDFLOTE COVER PAYS FOR ITSELF IN MONTHS ... builds profits by preventing evaporation, conserves product quality, retards tank corrosion ... is low cost, maintenance free, unsinkable, virtually indestructible ... easily installed ... longlife expectancy *(more than 10 years)*.

Constructed of rigid Polyisocyanate foam, a plastic material, the Hamondflote Cover is recommended for storage of Gasolines, Crude Oils and many liquid chemicals.

ONE USER REPORTS:

"The savings were apparent a week after it was installed and I highly recommend the Hamondflote Cover for all products, especially gasoline."

* *From the article, "Evaporation Loss Breakthrough," appearing in the April issue of Petroleum Marketer.*

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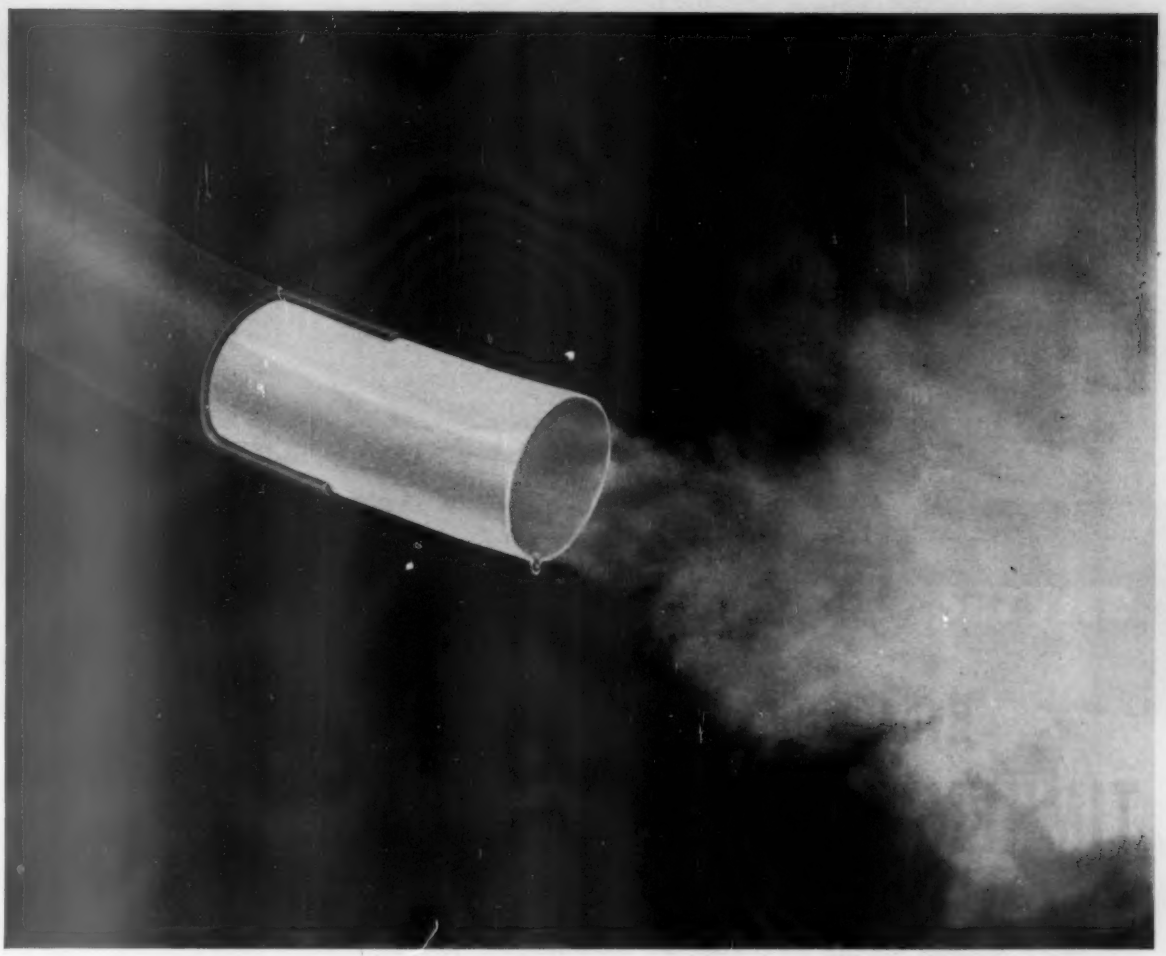
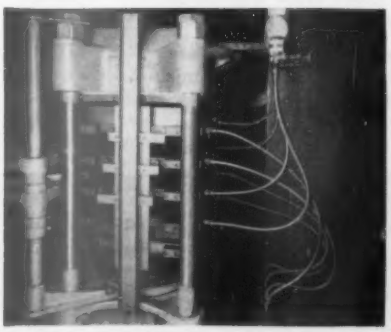


Meet your needs for HEAT RESISTANCE with hose of Du Pont TFE resins



Connections on this platen press carry 350° F. steam and condensate, alternating with 45°F. water. Hoses lined with TEFLON have withstood this service continuously since May, 1955, with no signs of cracking or wear. The anti-stick properties of the TFE resin markedly reduced plugging from scale formation.

TEFLON is Du Pont's registered trademark for its fluorocarbon resins, including the TFE (tetrafluoroethylene) resins discussed herein.

When hose lines must handle substances at high temperatures, and at the same time must withstand other rugged service conditions, hose lined with a TEFLON TFE-fluorocarbon resin provides an effective solution. TFE resins are rated for continuous use up to 500°F.; they are unaffected by virtually all acids and solvents; their "waxy" surface reduces contamination and holdup problems to a minimum. Hose lined with TEFLON will handle superheated steam, yet is useful even in liquid-oxygen service. And now, new constructions especially for industrial applications include fiber reinforcements, elastomeric coverings, convoluted tubing for greater flexibility, and a variety of industrial couplings.

In short, the unique combination of properties offered by hose lined with TFE resin makes it ideal for the most demanding applications in the chemical and petrochemical industries. For maximum service, minimum maintenance and replacement costs, consider using hose lined with TFE resins in your processes.

Ask your dealer, or write to: E. I. du Pont de Nemours & Co. (Inc.), Polychemicals Department, Room T-3097, Du Pont Bldg., Wilmington 98, Delaware.

In Canada: Du Pont of Canada Limited, P. O. Box 660, Montreal, Quebec.

DU PONT TEFLON®

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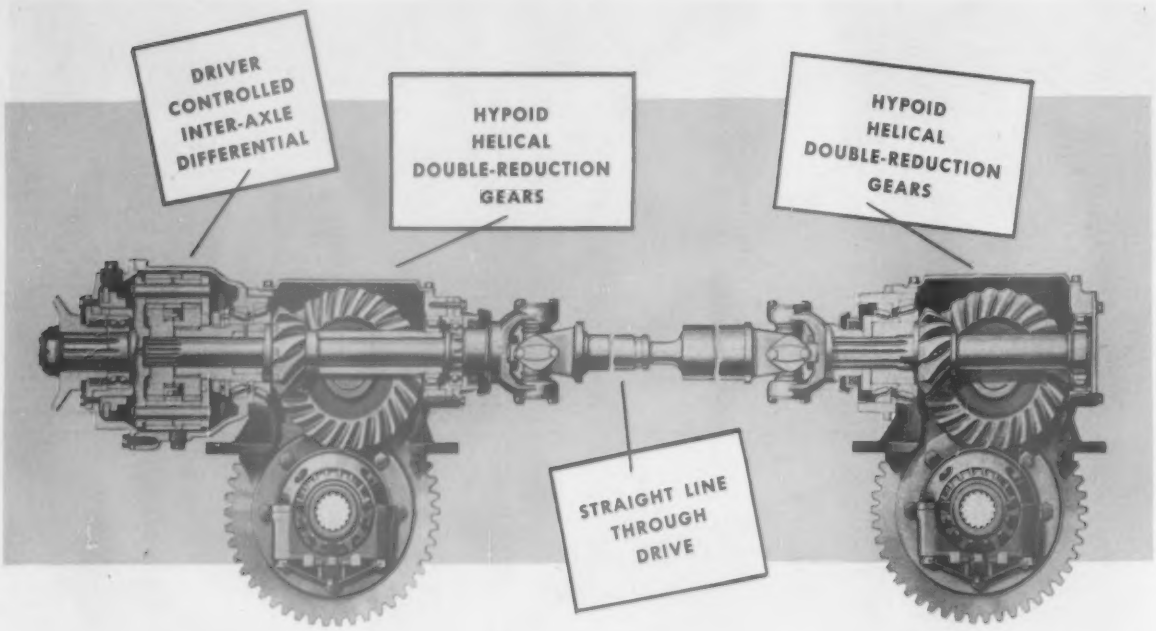
TFE-FLUOROCARBON RESINS

BETTER THINGS FOR BETTER LIVING . . . THROUGH CHEMISTRY


DRIVER CONTROLLED INTER-AXLE DIFFERENTIAL
HYPOID HELICAL DOUBLE-REDUCTION GEARS
HYPOID HELICAL DOUBLE-REDUCTION GEARS
STRAIGHT LINE THROUGH DRIVE

Hypoid Double-Reduction Gears Make

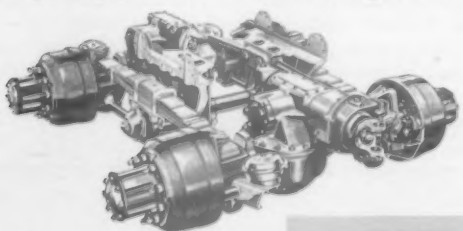
TIMKEN-DETROIT® HEAVY-DUTY TANDEMS

first in performance, long life and low maintenance cost!

Timken-Detroit Heavy-Duty Tandems with Hypoid Helical Double-Reduction Gears give you payload leadership, long trouble-free service, economical performance. Here's why –

True Double-Reduction. Two full sized gear sets form a balanced power train with each gear set accomplishing a healthy reduction. Husky hypoid first reduction gears and wide faced helical second reduction gears combine to form a rugged double-reduction drive that will outperform all others.

Widest Choice of Axle Ratios. Timken-Detroit "balanced design" full double-reduction does not limit the secondary gear set to a fixed low numerical value which depends on primary gear set for all ratio changes. The hypoid-helical gear arrangement permits a wider range of ratios because the numerical value of both the primary and secondary ratio gear sets can be varied.



Top-Mounted Straight Line Drive. Eliminates all prop shaft angularity. Bearing and gear life is increased. Maintenance costs reduced. Top-mounted position of carriers provides main drive shaft alignment – ideally suited for short wheel base trucks or tractors.

Driver Controlled Inter-Axle Differential. Divides torque equally between axles, yet compensates for any differential of speed between the axles. Both axles are always doing equal amounts of work . . . can be locked out at any speed when poor traction conditions exist.

Tough, Torsion Flow Axle Shafts Are Best By Any Test. Don't be misled . . . patented Torsion Flow Axle Shafts are still the best available to the American Trucking Industry. Comparison tests prove that Timken-Detroit Axle Shafts, spline diameter for spline diameter, are the toughest ever made.

©1959, R-S Corp.

World's largest manufacturer of axles for trucks, buses and trailers

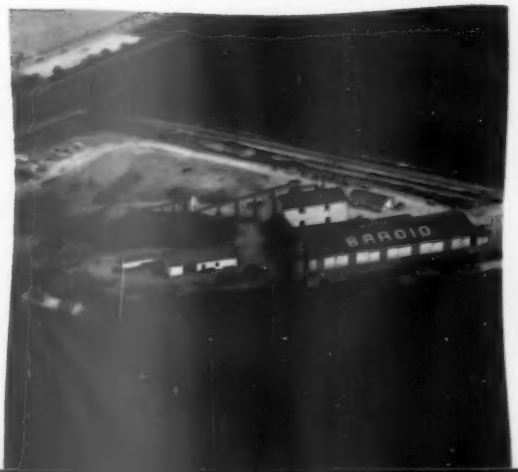
Another Product of... **ROCKWELL-STANDARD CORPORATION**

ROCKWELL R STANDARD

Transmission and Axle Division, Detroit 32, Michigan

port of call for better supply service

Look for the yellow and red
Baroid Supply Centers,
Marine Terminals or Inland Stores
—they give you the most
efficient *direct* service in
the mud industry.
This improved service is winning
more friends every day.



BAROID

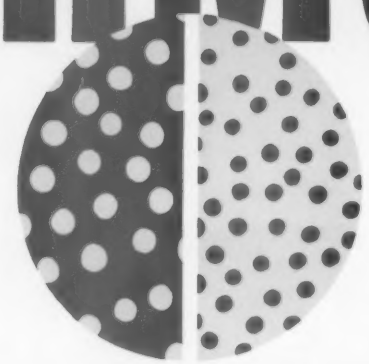
BAROID DIVISION • NATIONAL LEAD COMPANY
MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

5905

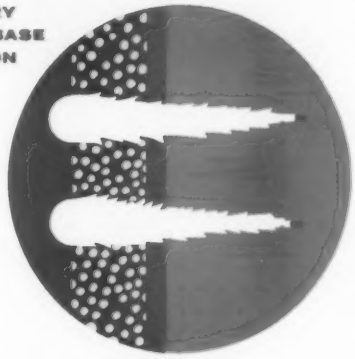
Seeing is believing . . .

INVERMUL*

BAROID'S *basic additive for* **OIL-BASE-** *emulsion drilling muds*



INVERMUL OIL-BASE EMULSION | ORDINARY WATER-BASE EMULSION

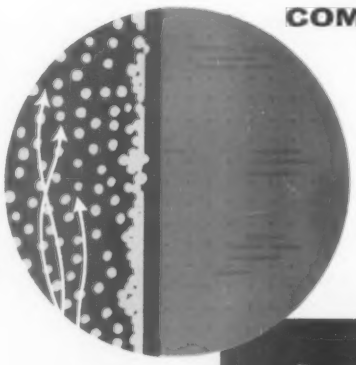


BETTER COMPLETIONS

INVERMUL . . . stabilizes oil-base-emulsion mud prepared with crude or refined oils.

INVERMUL MUD . . . protects formations against water damage.

INVERMUL MUD . . . is easy to maintain or recondition during drilling, coring or working-over.



WATER DAMAGE TO FORMATIONS MINIMIZED

BAROID

BAROID DIVISION NATIONAL LEAD COMPANY

MAIN OFFICE: P. O. BOX 1675, HOUSTON 1, TEXAS

* Trademark of Baroid Division National Lead Co.

5913

HANDLING "PROBLEM" FLUIDS OR GASES?

Specify ALUMINUM GATE VALVES by Darling

Aluminum flanged end gate valve. Also available with other types of ends. Can be furnished with inside screw stationary stem.

Where you're handling highly corrosive materials... or where valve weight is a factor... Darling Aluminum Gate Valves make sound economic sense.

High-corrosion-resistant aluminum alloys... carefully selected and thoroughly tested by Darling metallurgical engineers... are used for structural and pressure-containing parts. They've been *proved-in-use* as the most generally corrosive-resistant aluminum alloys in use today.

Double disc parallel seat principle assures maximum life under the most exacting service conditions. "No pocket" discs and wedges prevent accumulation of line scale or sludge. Wedge design reduces friction to a minimum, assures positive sealing and ease of operation.

DARLING VALVE & MANUFACTURING CO.

Williamsport 1, Pa.

Manufactured in Canada by Sandilands Valve Manufacturing Co., Ltd., Galt 19, Ont.

DARLING VALVES

Have you ever been troubled by any of these steam trap problems?

ARMSTRONG STEAM TRAPS are designed and made to eliminate these problems

BACK PRESSURE . . . Armstrong Traps operate on any back pressure—or vacuum, for that matter. As long as there is a pressure differential across the trap, it will close on steam and open for condensate. Even the high back pressure caused by blow through of one or more traps in the system will not disturb Armstrong Traps. Other than a reduction in capacity, Armstrong Traps are unaffected by back pressure.

DIRT . . . Armstrong Traps are not affected by ordinary dirt. When the trap opens condensate swirls down under the edge of the bucket and up through the discharge orifice. Dirt is kept in suspension and discharged along with the condensate. For very bad dirt conditions, Armstrong offers traps with integral strainers. These cost less than a trap plus a separate strainer.

AIR BINDING . . . Armstrong Traps cannot air bind. Air in the system passes through a vent in the top of the bucket. It collects in the top of the trap and is discharged with the condensate. There is no chance for it to stop the trap. For low pressure on-and-off units where large amounts of air accumulate while the steam is off, Armstrong offers open float and thermostatic air vent traps in a complete range of sizes.

WIRE DRAWING . . . Armstrong Traps are designed and made to resist wire drawing. The valve and seat are tough stainless steel. The valve opens and closes tightly with a fast action and is always water sealed. There is virtually no chance for grit or sediment to lodge in the valve, virtually no chance to create conditions that lead to wire drawing.

There's no need to accept any of these problems as "inevitable." Your local Armstrong Representative can show you how to end them all. Call him today or write direct.

860 Series for low pressure heating service.

800 Series, side inlet, side outlet.

No. 801, side inlet, bottom outlet.

880 Series, integral strainer.

200 Series, bottom inlet, top outlet.

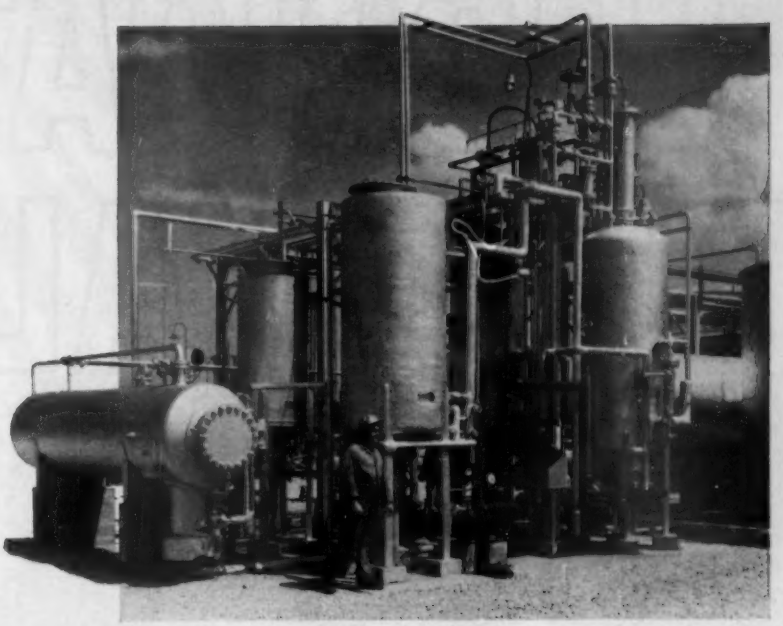
Forged Steel Series for high pressures, high temperatures.

The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

ARMSTRONG MACHINE WORKS

8684 Maple Street Three Rivers, Michigan

PRODUCT IMPROVEMENT WITH **PETRECO**



Let's get together on your next separation problem!

ELECTROFINING* Precipitation Equipment has been helping to solve treating and separation problems in the petroleum industry for many years.

Properly applied, it efficiently separates one liquid phase from another, and is being widely used today to contact or "scrub" hydrocarbons with chemicals in aqueous solution, acids, caustics and doctor solutions, to name a few.

Such contact is carried on in a closed system. Controls are set after the most effective treating conditions have been established by pilot testing; treatment is completely automatic.

In any operation where the mixing of two immiscible liquids is necessary, the formation of stable emulsions is always a possible complication. ELECTROFINING Precipitation Equipment demulsifies and separates such phases quickly, cleanly and without entrainment, provided the external phase is nonconductive and the dispersed phase conductive.

IF A SEPARATION PROBLEM IS PLAGUING YOU, we'd like to have the opportunity to sit down and discuss it with you. Or, if you prefer, write us first—describing your problem, product and type of operation. There's no cost or obligation, of course.

*"ELECTROFINING" *is a registered trademark of Petrolite Corporation*

CP-59-1

PETROLITE CORPORATION

PETRECO DIVISION
3202 South Wayside Drive (P.O. Box 2546), Houston 1, Texas
1390 East Burnett Street (P.O. Box 7216), Long Beach 7, California

CANADA: Petrolite Corporation of Canada, Limited, 4528 Stanley Drive, Calgary, Alberta

ENGLAND: Petrolite Limited, Heathcoat House, 20, Savile Row, London W. 1.

VENEZUELA: South American Petrolite Corporation, Hotel Avila, Caracas

REPRESENTATIVES

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COLOMBIA: W. F. Faulkner, Calle 19, No. 7-30, Office 807, Bogota
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JAPAN: Chiyoda Chemical Engineering and Construction Company, Ltd., Tokyo Bldg., No. 3, Marunouchi 2-Chome, Chiyoda-Ku, Tokyo
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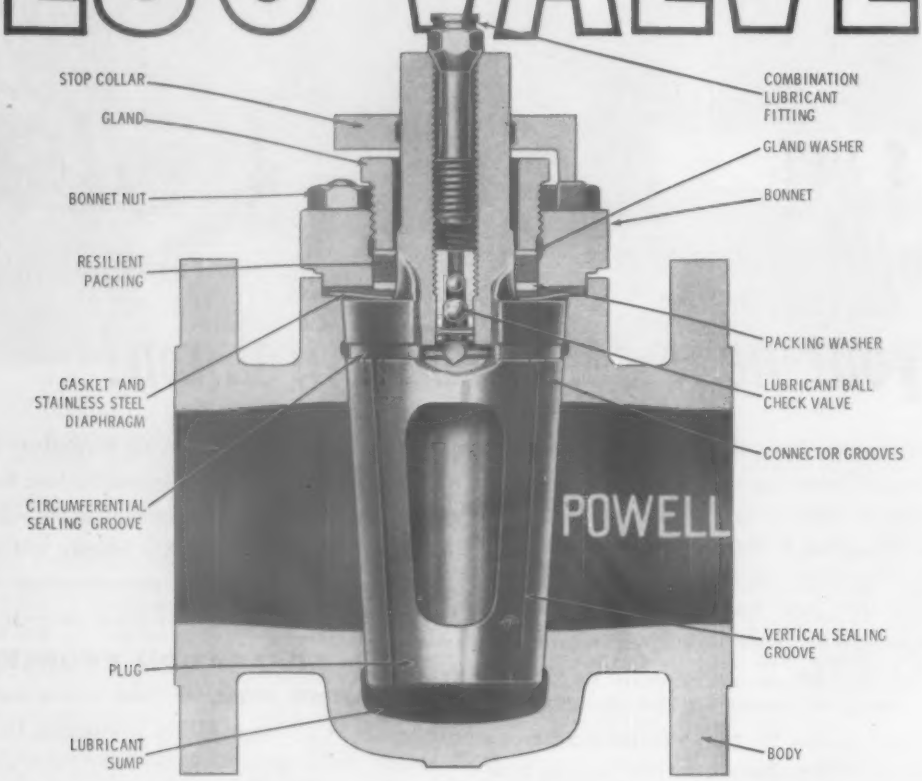
POWELL

LUBRICATED PLUG VALVES



Sectional view Powell Screwed Gland Lubricated Plug Valve.

Like all Powell Valves, Powell Lubricated Plug Valves are superior in their field . . . and have many advantages over other conventional types of Valves.

- Simple design: only three basic parts—Body, Bonnet, Plug.
- Quick, complete shut-off—a quarter turn will close or open the valve.
- Tapered Plug assures positive seating.
- Machined surfaces of plug and body are not exposed in the open position. Any media adhering to the plug when in the closed position is removed when plug is rotated.
- Cavity-free straight passage assures streamlined flow in either direction. Scale and sediment cannot collect.

Powell Lubricated Plug Valves are available in sizes ½" through 16", depending on the type required—Semi-steel 175 and 200 pounds WOG;—Carbon Steel ASA 150 and 300 pounds.

Powell can also furnish Lubricated Plug Valves in other alloys on special order.

For all your valve needs, make it a policy to consult your local Powell Distributor—or write directly to us.

THE WM. POWELL COMPANY

Dependable Valves Since 1846 • Cincinnati 22, Ohio

LESS BOILER MAINTENANCE BECAUSE A LJUNGSTROM® CUTS SLAGGING

A Ljungstrom air preheater reduces slagging and cuts boiler downtime by boosting combustion air temperature, in some cases by as much as 1000°F. Whatever fuel you use, hotter combustion air makes it burn more cleanly and completely, with less slag and deposits.

More complete combustion also makes standard equipment work at top efficiency, producing more heat from less fuel. One east coast refinery saves $129,000 a year on their fuel bill through increased furnace efficiency. This increased efficiency contributes to an upgrading of the product by 1½ octane numbers, providing an additional annual profit of $58,000.

How fast is "WRITE-OFF"?

Savings like these — where equipment makes a better product . . . lasts longer . . . and costs less to maintain — can pay for a Ljungstrom air preheater *in as little as two years.* Or, if you use the higher combustion efficiency of a Ljungstrom-equipped furnace to increase throughput, write-off time can be cut to nine months!

For further information on potential fuel economy, write today for your copy of a factual article by O. F. Campbell describing one company's fuel savings with a Ljungstrom air preheater. Call or write The Air Preheater Corporation.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N. Y.

MR. P. C. SPENCER

Chairman of the Board
Sinclair Oil Corporation

"A vital part of the oil industry . . ."

"The success of any company, large or small, is governed by its people. Our industry, above all, relies on their inquisitiveness, their ideas, their dedication.

"And this industry has offered the opportunity to exploit the ideas from which come new products and goods that enrich our lives.

"From this 'freedom to develop' atmosphere have come literally thousands of oil end-products ranging from tooth brushes and fine fabrics to tires for your car. But this is only a part of the story. We dare not overlook, nor fail to credit, the thousands of people and the many companies whose engineering and research talents have played a major part in this developmental success—those who operate behind-the-scene, so to speak—those who furnish the equipment and services to drill and produce the oil and gas.

"I speak of the Manufacturing, Service, and Supply companies. A vital part of the oil industry, they provide equipment, processes, research and engineering skills that have helped make our industry what it is today . . . a free enterprise working for a better way of living for people the world over."

P.E.S.A.

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

PROUD TO BE PART OF A PIONEERING INDUSTRY

PETROLEUM EQUIPMENT SUPPLIERS ASSOCIATION

Diamonds Mean Economical "Down to Stay" Drilling!

Due to the right combination of long-wearing diamonds and matrix engineering, Christensen Diamond bits stay on the bottom longer, reducing the non-productive man hours necessary to complete costly round trips. The excellent cutting action of diamonds requires less weight which produces a straighter hole, and, with no moving parts, the diamond bit reduces the possibility of additional round trips for replacement. Advantages like these mean a savings of time and money for you. Call your nearest Christensen field consultant, and he will recommend the right bit designed for your job. Call him today, and on your next drilling job let Christensen Diamond bits help you operate at "less cost per foot."

Diamonds Mean, "Less cost per foot."

CHRISTENSEN DIAMOND PRODUCTS

1937 SOUTH SECOND WEST • SALT LAKE CITY, UTAH

Underground and overhead:

the West relies on Sheffield steels

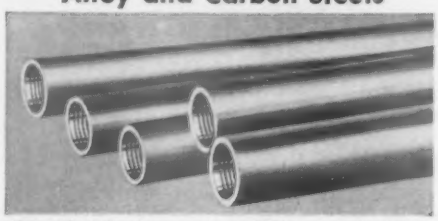
You can bet your life on Sheffield quality. Flying crews do, in planes using Sheffield aircraft quality steels. Oil crews do, in offshore drilling rigs 50 miles out in a raging sea.

But safety is only one demand the oil and aircraft-missile industries place on alloy steels. Each of the many Sheffield alloys is "tailored" to specific end uses. Each must have the right combination of weight, strength, hardness, ductility and many other precisely formulated properties. Sheffield metallurgical skill, heat treating techniques, and quality control assure this.

Something else you're sure of with Sheffield: prompt delivery and most favorable shipping economies. That's because Sheffield is strategically located to serve Mid-America, the Southwest and the West Coast. If you use steel in manufacturing, find out the advantages of dealing with Sheffield. Get in touch with us.

SHEFFIELD

Alloy and Carbon Steels



Sheffield alloys for DRILL COLLARS

As oil wells go deeper, drill pipe strings must be longer. That means more drill collars are needed. What's more, they must be made of special quality alloy steel, to keep the pipe in tension while applying the right weight to the bit for best rate of penetration. Steel for drill collars is just one of hundreds of uses of Sheffield steel in the oil industry.

SHEFFIELD DIVISION

ARMCO STEEL CORPORATION

OTHER DIVISIONS AND SUBSIDIARIES: Armco Division • The National Supply Company • Armco Drainage & Metal Products, Inc. • The Armco International Corporation • Union Wire Rope Corporation • Southwest Steel Products

For "set it and forget it" gas drying—

Come to Kemp

Kemp Dryer protects instrument lines at −25° for Quaker State's Farmer's Valley, Pa. plant. Fully automatic operation saves time and manpower, yet provides dependable service on a 24 hour basis.

Here's the nerve center of every Kemp Fully Automatic Gas Drying Unit. Drying process gasses and inerts . . . air for pneumatic instruments and tools . . . liquids . . . for pressurizing anhydrous liquids . . . this panel controls the Kemp Dryer surely and safely. Once timed to meet your program, it provides efficient drying on a continuous basis, without worry or excessive maintenance.

Note the precision with which even the wiring is connected. It's typical of the thorough workmanship going into every component of the Kemp Dryer. Kemp Dryers are built with care; built to last and perform year after year with dependability resulting from a quarter century's experience.

Whether your operation calls for a completely automatic Kemp Dryer, a semi-automatic model, or a simple, manually operated unit, there's a model and capacity to meet your needs. Kemp Field Engineers will gladly study your problem and make complete recommendations, even down to the proper desiccant (we select from over 20) to do your job best.

Your Kemp Representative is listed in *Chemical Engineering Catalog*. Call him for full information when you plan a new installation or wish to update an old one. Or write for Bulletin D-102. THE C. M. KEMP MFG. CO., 405 E. Oliver St., Baltimore 2, Md.

Convection Dryers

Inert Gas Generators

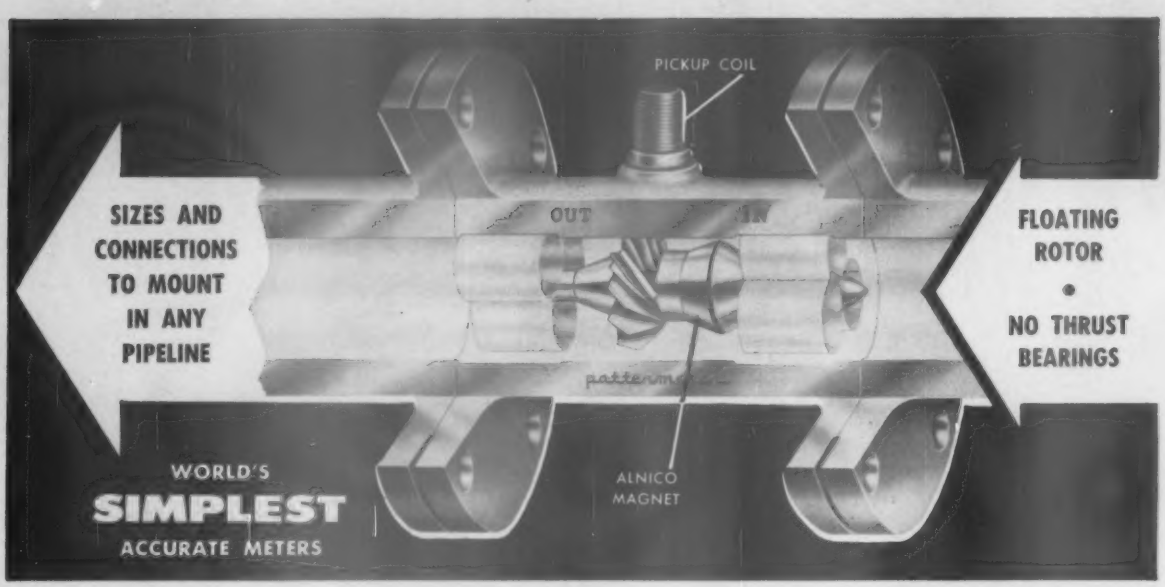
KEMP

Nitrogen Generators

Oriad Dryers

pottermeter BOWSER 0.1 GPM TO 40,000 GPM

ELECTRONIC TURBINE TYPE METERS



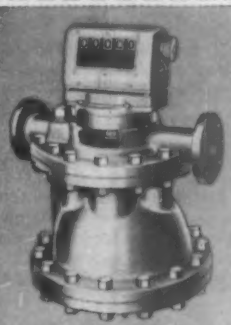
for PETROLEUMS • CHEMICALS • FOODS
PHARMACEUTICALS • INDUSTRY LIQUIDS

A magnet built into the turbine driven rotor generates electric current directly proportional to the flow rate of liquid in the pipe. This impulse is used to activate electronic control and readout equipment near the meter or at remote locations. Accurate over wide range of flow rates and pressures. Handles liquids and gases.

Flow Ranges	to 40,000 g.p.m. and more
Operating Pressures	Unlimited
Temperature Ranges	−455° F. to +1500° F.
Pressure Drop	Virtually Nil
Connections	No limitation
Construction (standard)	Type 316 stainless steel with Carpenter #20 Rotor

READOUT and CONTROL equipment as needed

Potter-Bowser engineers gladly confer with systems engineers to provide data on any application requirements.



BOWSER XACTO METERS

BOWSER XACTO METERS AND PROPORTIONERS
positive-displacement piston type

Wherever mechanically driven readout and control equipment is indicated, and where positive-displacement metering is needed or costs less, Bowser Xacto Meters (leading all others in industry) are unexcelled for dependability and accuracy.
Capacities: 6 GPH to 250 GPM

Xacto Meter equipped proportioners are used to blend two or more liquids in continuous flow at accuracies to ¼ of 1 percent. First in lube oil blending, Bowser proportioners also handle most other liquids used by process industries.

BOWSER PROPORTIONING BLENDERS

Write For Catalog

Potter-Bowser Division **BOWSER, INC.** *Fort Wayne, Indiana*

MUD MEN:

Here's new mud data on why improved Attapulgus Drilling Clay is becoming so popular for all muds. This could be the most important bulletin you've ever read. To get your copy sign your name, address here:

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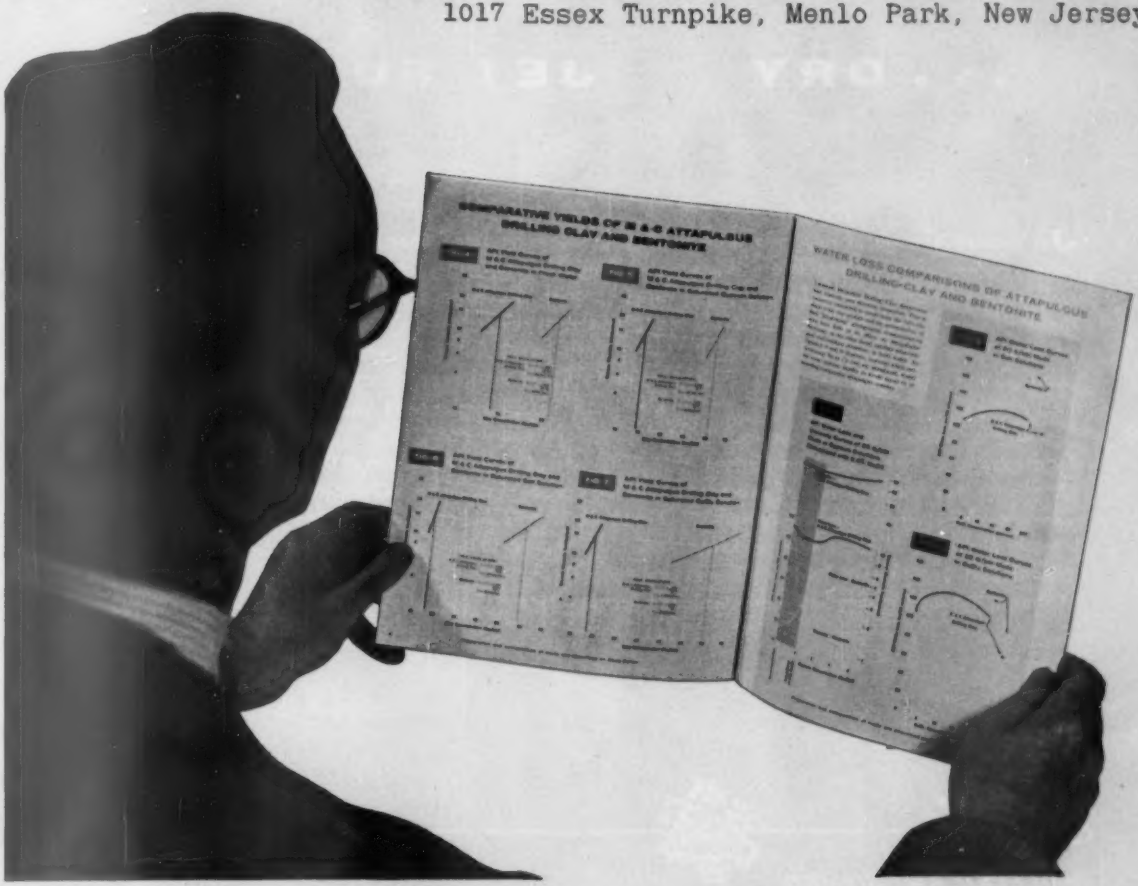
rip out this page and mail to:

MINERALS & CHEMICALS CORPORATION OF AMERICA

1017 Essex Turnpike, Menlo Park, New Jersey


COMPARATIVE YIELDS OF M & C ATTAPULGUS DRILLING CLAY AND BENTONITE
WATER LOSS COMPARISONS OF ATTAPULGUS DRILLING-CLAY AND BENTONITE

. . . DRY JET FUELS

Jet aircraft now get a new and wider safety margin when their fuels are dried with LINDE Molecular Sieves. Even at high fuel flow rates, water normally absorbed at ground level is reduced to less than 10 ppm—eliminating ice-blocked fuel lines at high altitudes.

Liquids never before dried-successfully by desiccants can now be dried commercially with these new zeolite adsorbents. Examples are acetone and other ketones, ethanol and other alcohols, and most saturated and unsaturated hydrocarbons. Drying to less than 1 ppm is now practical in dynamic systems. Due to their high water adsorbing capacity, LINDE Molecular Sieves bring pronounced savings in investment and operating costs.

No matter what the liquid—whether attempts to dry it have succeeded or failed—we would like to discuss with you what a Molecular Sieve design can do.

Write Linde Company, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Address Dept. 0-91

Linde MOLECULAR SIEVES

UNION CARBIDE

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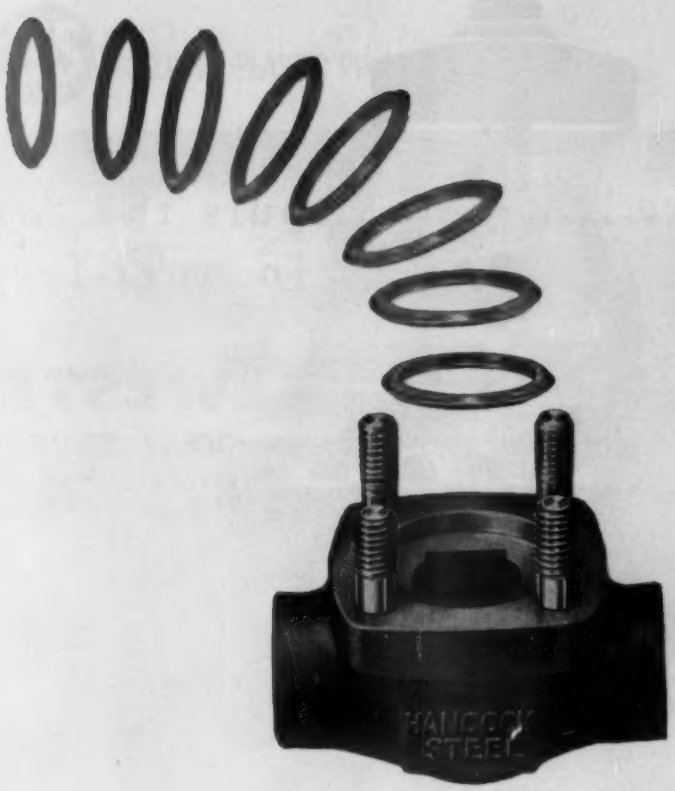


RING OF STEEL

Defies Pressure Times Ten

The Flexitallic gasket in the bonnet joint of Hancock Steel Gate Valves cannot blow out even if pressures exceed ten times the rating of the valve. Valve maintenance and equipment down-time are greatly reduced. Made of a spiral-wound ribbon of stainless steel with asbestos filler, the gasket has spring-like compressibility — cannot be flattened.

Only the specially-designed Hancock bonnet joint with built-in compression limit can make full use of the positive sealing power of this ring of steel. Such advanced valve engineering is one example of total Hancock quality that assures trouble-free performance. Your nearby industrial supply distributor will gladly explain every economy feature of Hancock Steel Gate Valves. Phone him today.

Hancock 800# Steel Gate Valve, Type 950. Sizes: ¼" thru 2".

HANCOCK STEEL VALVES

A product of

MANNING, MAXWELL & MOORE, INC.

Consolidated Ashcroft Hancock Division • Watertown, Massachusetts
In Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario

$q = hA\Delta T$.....puts the *"anti"* in anti-freeze!

WESTERN

HEAT EXCHANGERS

WESTERN SUPPLY COMPANY

P. O. Box 1888 – Tulsa, Oklahoma

Anti-freeze is but one of many products whose origin can be traced to the South Works of Wyandotte Chemicals Corporation, Wyandotte, Michigan. In the Propylene Oxide Plant of the South Works, shown above, Western Heat Exchangers render a significant and vital service to Wyandotte's continuing growth in organic oxide chemicals.

Precise engineering, practical design and close attention to detail characterize all Western heat exchangers — tailored to the process requirements of the nation's leaders in petrochemicals.

A Western representative stands ready to help with your heat transfer requirements.

USCOLITE PLASTIC PIPE

CONFUSED ABOUT PLASTIC PIPE?

(MOST EVERYONE IS)

Here's your guide:

U. S. Uscolite® CP acrylonitrile-butadiene-styrene copolymer (ABS-I) pipe is best where maximum resistance to impact is demanded. It will safely handle most chemicals of industrial importance at working temperatures up to 170°F. This is the major plastic pipe used by chemical processing industries.

U. S. Uscolite RV polyvinyl chloride (PVC-I) pipe is best for extremely active oxidizing agents such as strong sulphuric, nitric and chromic acids. This unplasticized, unmodified Type I PVC has high impact strength and handles temperatures up to 140°F, far in excess of normal requirements.

Uscolite HT (ABS-II) pipe is a new addition to the resin-rubber compounds. HT stands for exceptionally High Tensile qualities, plus much better retention of physical properties at High Temperatures.

These types of Uscolite Pipe cover all requirements, not only because they are virtually immune to internal and external corrosion, but they are non-contaminating, odorless, impart no taste or discoloration. Because of these qualities they are approved by the National Sanitation Foundation for carrying drinking water. The use of Uscolite results in a saving of appreciable dollars in installation costs and reduction in man-hours. The skills to install metal pipe are not required to install Uscolite. Assembly can be accomplished in half the time. *Not one foot of Uscolite Pipe has ever failed in service when used in accordance with our recommendations.*

A fourth pipe, *UscoFlow HT (ABS-II)* is a black utility pipe, especially suitable where low first costs are a factor. It's a blend of styrene-base resin and synthetic rubber for good impact resistance and high tensile strength. UscoFlow is the ideal answer to builders and large developers who are seeking long-lived, maintenance-free pipe for plumbing.

We invite detailed inquiries or call your "U. S." plastics distributor. He has the *largest* line of plastic pipe and fittings, plus an experienced background to settle any and all questions about which pipe to use.

Mechanical Goods Division

United States Rubber

WORLD'S LARGEST MANUFACTURER OF INDUSTRIAL RUBBER PRODUCTS

Rockefeller Center, New York 20, N.Y. In Canada: Dominion Rubber Company, Ltd.

Century Electric 25 hp motor driving unit pumper in Harris County oil field.

Why Century Electric motors help cut oil field operating costs

Here's why a Century Electric motor was selected to drive this Texas oil field unit pumper—

DEPENDABLE POWER. All Century oil field motors have these long-life features:

Rotor receives special balancing test before shipment . . . makes it smooth running and assures long bearing life.

Windings are insulated with tough polyvinyl acetal insulation which has great mechanical and dielectric strength.

Special stator insulation system includes several coats of high-temperature phenol-formaldehyde baking varnish . . . result gives protection against oil fumes, alkalis, dust and dirt.

Cast iron or steel frames are designed to withstand demands of the toughest installation.

Dripproof enclosure protects motor against rain, snow, dust and dirt. Rodent screens for dripproof motors prevent service interruptions at isolated installations. Totally enclosed motors are also available.

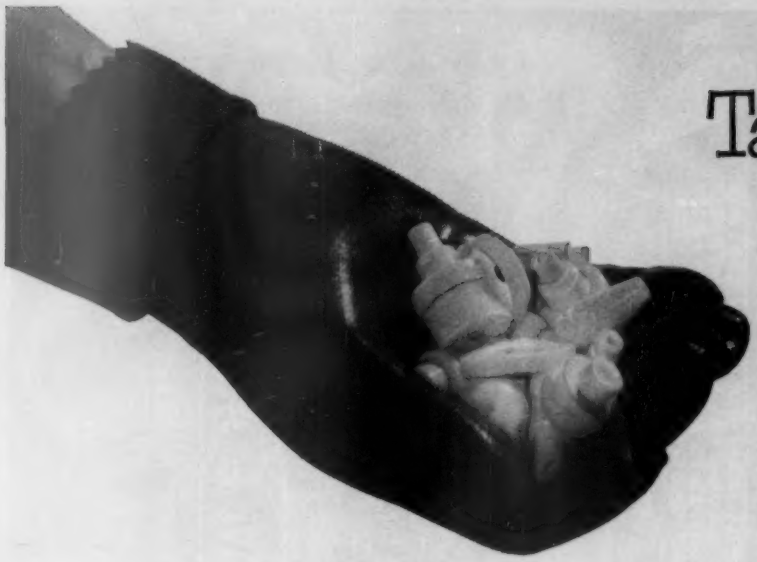
APPLICATION AID. Century Electric application engineers can help you get the right motor for your drilling, production pipe line or refining job from the 10,000 types Century makes. For instance, on the unit pumper shown above, one problem was to supply high starting effort. The Century Electric SCH motor with at least 200% starting torque does the job. Result: dependable motor power and lower operating costs. For more information contact your nearest Century Electric sales office or your supply store. For more than a motor . . .

CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century

59-19



Tailor-made, tough and chemically inert...

. . . these J-M Chempac Teflon components combat chemical and solvent action!*

SMALL OR LARGE . . . intricate or simple . . . J-M Chempac® Teflon components have proved their exceptional resistance to the constant attack of corrosive chemicals in rugged service.

Look to J-M for Teflon packings, gaskets, and moulded shapes made to your exact specifications . . . or for parts that are machined to close dimensional tolerances. Moreover, we can combine Teflon with top quality J-M asbestos to impart the exceptional sealing and heat-resistance properties of the "magic mineral." And in addition to corrosion-resistance, Teflon gives you the advantages of an extremely low coefficient of friction . . . toughness and flexibility . . . and weight-saving possibilities.

You can also obtain J-M Chempac Teflon Packings in moulded and braided types for pumps and valves . . . in a wide range of flange and envelope-type gaskets . . . in rings, cups, sheets and tapes. Your J-M Packings Distributor can supply your needs. Or write Johns-Manville, Box 14, New York 16, New York. In Canada: Port Credit, Ontario.

*TM for DuPont Tetrafluorethylene resin.

Teflon rods, tubes, tapes and sheets —in addition to components of varied sizes and shapes as indicated here—are also available from Johns-Manville. Prompt delivery of any quantity you need is assured by new J-M production facilities.

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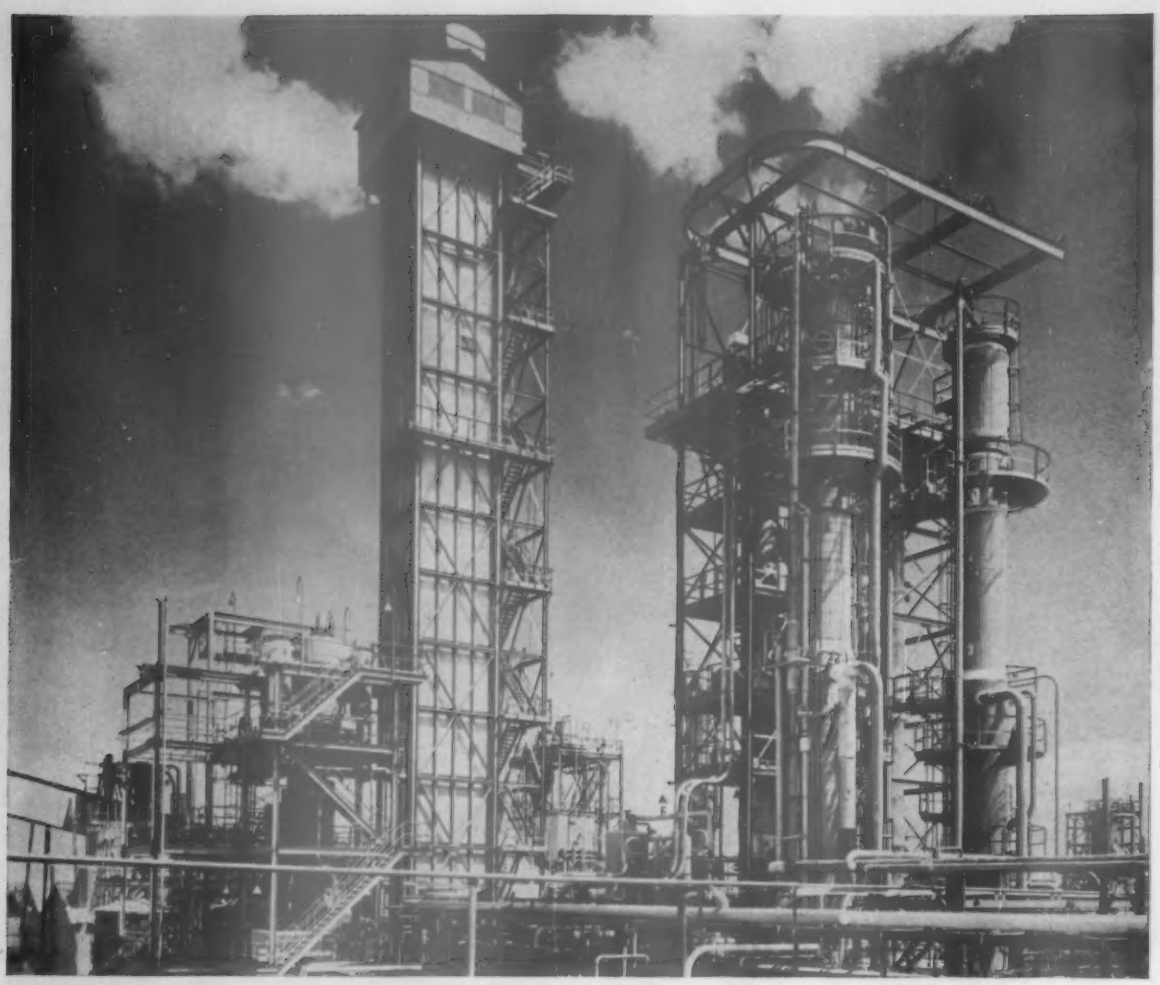
JOHNS-MANVILLE



A precedent-setting new concept in engineering service

The Pechiney-Grace Urea Process by Foster Wheeler

Now Pechiney's basic urea synthesis, Grace's operating experience and Foster Wheeler's engineering design and construction experience are available as a totally new packaged service to licensees.

It's a unique package, giving you:

- a total recycle process covered by one licensing agreement, from feed end through finishing operations, yielding urea of the highest purity.
- the benefits of experience gained by W. R. Grace in modifying and improving the original Pechiney Process and operating a full-scale plant for four years.
- Foster Wheeler's experience in originally bringing the Pechiney Process from pilot plant to full-scale commercial operation, and working with Grace engineers on subsequent improvements which created the Pechiney-Grace Process.

The new license package also makes available for the first time a new ammonia recovery system—currently saving 10-15 tons a day for Grace, and a highly efficient purification system. For information write to: *Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, N. Y.*

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They Say—

Of interest to pipeliners

Dear Sir:

Our engineering organization was tremendously interested in your July 13 issue "Pipeline Costs Vary All Over the Map" (p. 89) and also in the earlier pipeline construction section ("Pipeline Contractors Costs," OGJ, Jan. 20, 1958, p. 105).

C. M. Brecheisen, Manager
Eastern Pipeline Division
Socony Mobil Oil Co., Inc.

One thing led to another

Dear Sir:

Atlantic Refining Co.'s cut in the price of East Texas crude oil climaxes the working of mandatory import controls as currently administered.

The advocates of mandatory controls probably had no anticipation that the working of these controls could produce the opposite result of that intended. Maybe it will eventually dawn on the so-called independent producers and their allies, the politicians, that in this world of overproduction they cannot both have and eat their cake.

When the regulations of mandatory import control gave an import quota to every oil refiner in the business, it was easy to predict the effect would be bad.

To elucidate: It being impractical for every refiner to use in his plant his import quota, what does the nonuser of an import quota do?

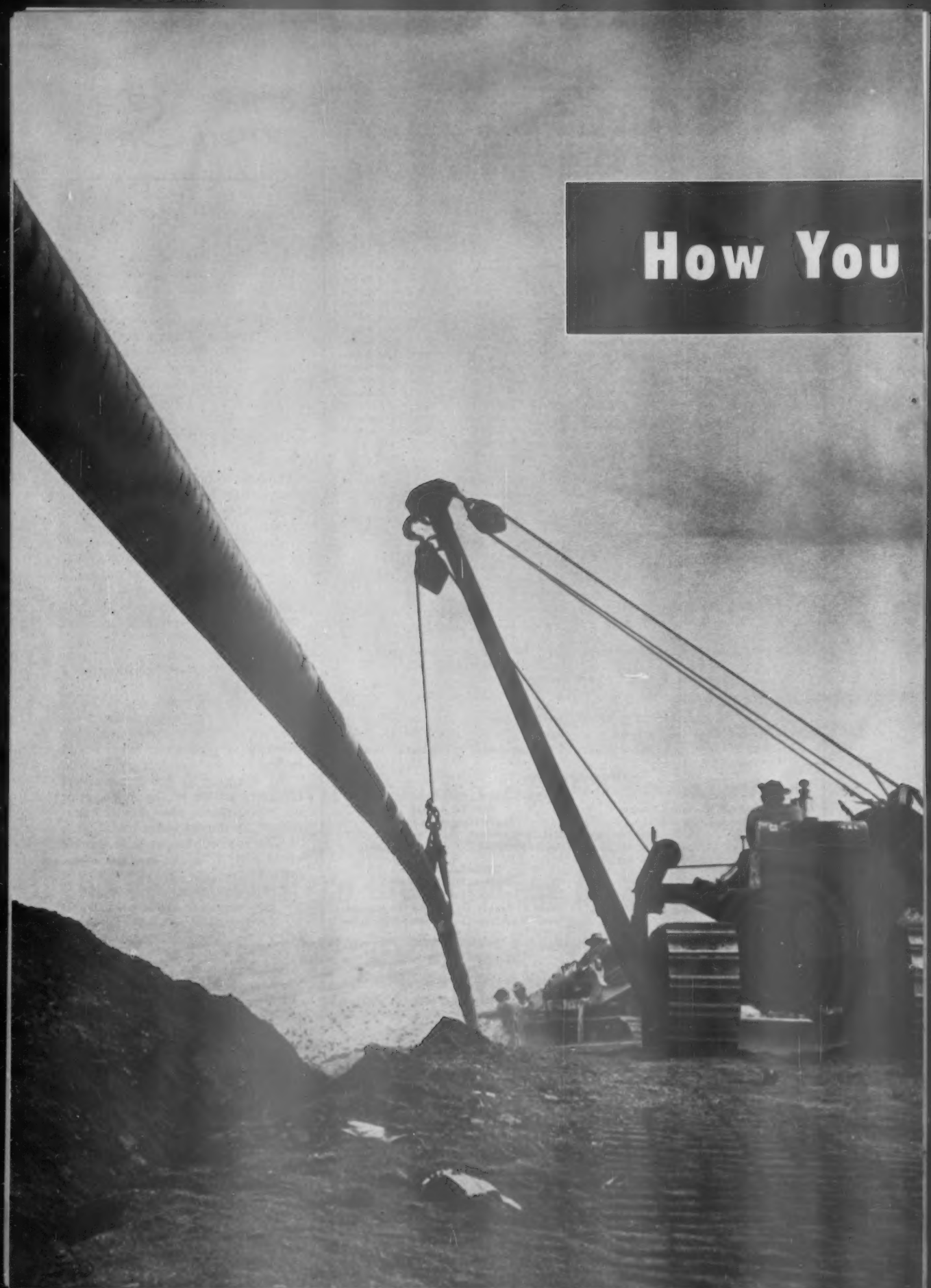
1. It is worth his while to use his quota only if he can buy his allocation of imports at cut-rate prices.

2. He then trades his cut-price oil for local domestic crude on a barrel for a barrel basis with some other refiner who can receive and use imported crude.

3. This gives the nonuser a built-in bonus or windfall, an extra leverage or advantage, when competing for the markets for refined products in oil's highly competitive markets, of which he takes the fullest advantage.

4. This works out in the final accounting that the user of imported crude (particularly if he is not the producer of the crude) is processing posted price or high cost crude while the nonuser of imported crude is processing the equivalent oil for which he paid a cut-rate price.

5. The user of imported crude, being mindful of the administration's


How You

Profit with J&L Electricweld

J&L Electricweld Line Pipe insures fast economical pipe line construction. Uniform high ductility means easier field bending. Lengths are uniformly round. They line up end to end in perfect butt joints with uniform bevels for fast dependable welding. Multiple testing of every length of *J&L Electricweld* is your assurance of better performance during installation and during operations.

(1) After the pipe is welded, the weld area is annealed and subjected to an ultrasonic inspection.

(2) Every length is pressure-tested under the specified A.P.I. or A.S.T.M. hydrostatic test requirement. Pneumatic hammers strike the pipe while it is under pressure to build up pressure surge.

(3) A series of visual inspections is made on every length of *J&L Electricweld.*

(4) Every length of pipe is given a crush test to determine weld strength and steel quality. The test complies with requirements of A.P.I. 5L, 5LX and with A.S.T.M. A-53, A-135 and equivalent specifications.

(5) Both ends of every joint of *J&L Electricweld Line Pipe* receive a magnaflux examination.

J&L Electricweld is available in sizes 6⅝" O.D. through 12¾" O.D.

Discover how you can profit by using this high quality pipe in your next line. Call your local J&L Supply man today.

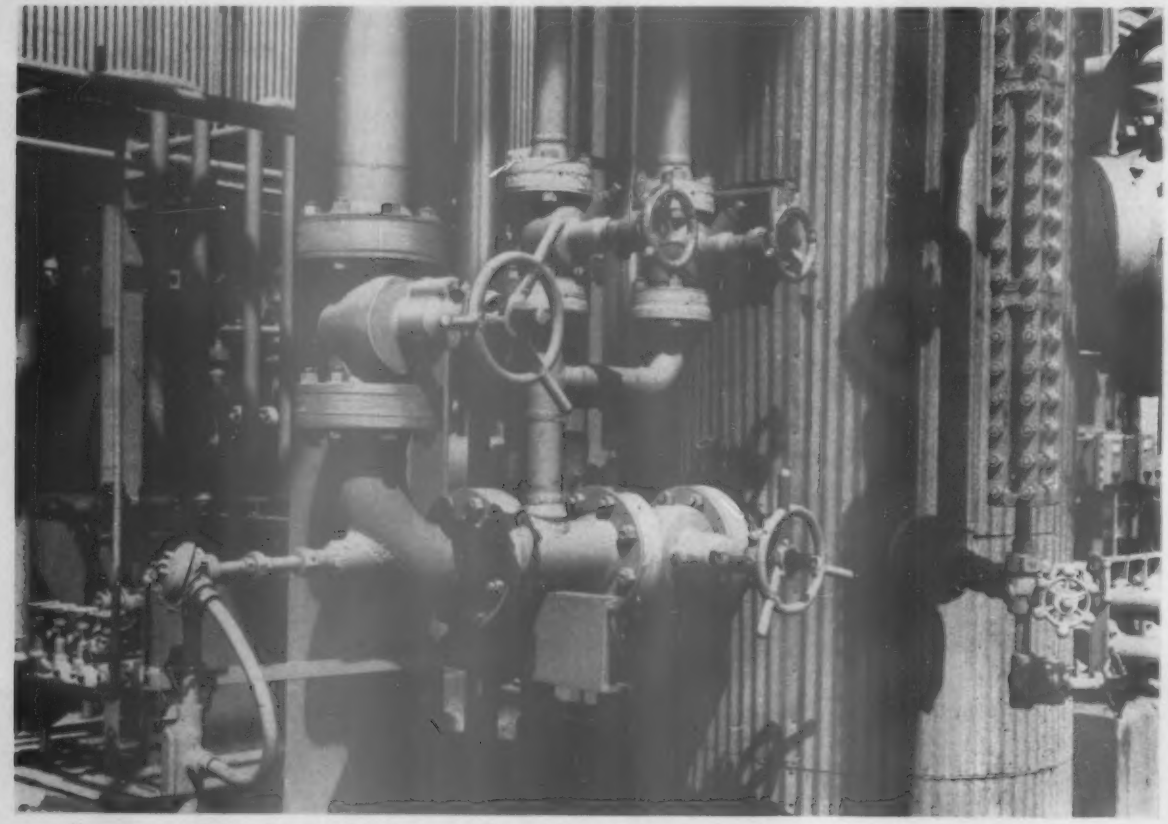
Jones & Laughlin

SUPPLY DIVISION – Tulsa

If it's sold by J&L....
It's the best available

STOP PRODUCT CONTAMINATION BEFORE IT BEGINS BY USING ORBIT FORGED STEEL VALVES

Because of the non-lubricated positive closure seating principle used in the Orbit Valve, costly maintenance and the possibility of fluid contamination carry-over from valve lubricants which lower catalyst efficiency has been eliminated. Lubricant is not required for any part of the valve's mechanism that comes in contact with fluid being handled in cavity of valve.



Service shown here: Hydrogen Plant — Makeup Unit to Dehydrator.

Literature: Write Department B for Catalog 58-B and Service Manual No. 58.

Source: Available through your favorite industrial supply house.

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threat of product price control, has only one defense against this kind of competition, that is, reduce the price of his purchased domestic crude.

6. Thus, the practical effect of mandatory control of imports has been for higher cost of petroleum products around the borders of the country than in the interior.

7. Depressed product prices react back to the producer in the form of reduced posted prices for his crude oil.

8. Another demonstration that government regulation brings no good to anyone.

R. F. Baker
Pelham, N. Y.

Bad judgment

"The industry has experienced destructive price deterioration in the face of rising demands, growing costs, and brisk business activity in virtually every other phase of our economy. No such contradictory symptoms afflict any other major industry.

"There is something wrong with this picture. Obviously, the immutable laws of economics have not been repealed. The unhealthy conditions which have become so chronic in this great industry of ours must be the result of collective bad judgment at management levels.

"This is a time for those in positions of responsibility to take a determined look at industry conditions."

Gordon Simpson, president, Independent Petroleum Association of America, in an article in the Independent Monthly, association newspaper.

Wants higher price at pump

"To my mind retail petroleum prices should be increased. We need reasonably higher prices to permit a larger margin for you who are charged with selling the products, your supplying company, all other divisions of the oil industry, and for the many thousands of individual stockholders who also have an important stake in our business.

"As you know, state and federal gasoline taxes have increased many times in past years, yet, exclusive of these taxes, gasoline prices have risen only 6% above 1925 levels.

"On the other hand, automobiles during the same period have gone up 164%, shoes 142%, bread 100%, and so on. Of course, your costs and your supplier's costs have increased in proportion to those of other industries, yet we have not been able to increase our gross margins sufficiently to match these costs.

"Net profit is naturally our main

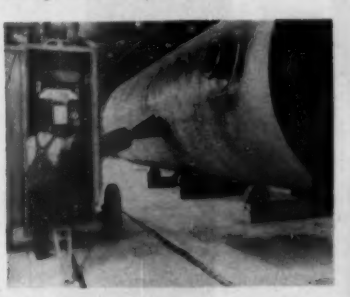
PROCESSING EQUIPMENT
fabricated by FLINT . . .

is used in many of the newer petroleum and chemical plants where exacting specifications to achieve maximum performance are a must.

Flint's plate fabricating facilities are among the largest in the country and seldom can be pushed to capacity. Highest quality control is exercised while tight delivery dates are met.

In the plant, eight and one half acres under roof, more than 61,000 sq. ft. of manufacturing area handles nothing but plate.

All pressure vessels are fabricated to ASME code, from Carbon, Alloy, and Alloy Clad Steels.



Flint X-ray equipment is used to check all weld seams before shipment.

ALSO: Fabricated Galvanized Steel
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STEEL PLATE FABRICATORS ASSOCIATION

STEEL IS AVAILABLE NOW

You can't

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Use a safe wire rope...use

CF&I-WICKWIRE

This giant steelman is the Image of CF&I—and of the many steel products produced by CF&I for every type of industrial use. He represents the quality controls that CF&I exercises during every step of manufacture—from ore to finished product.

Nowhere is this exacting attention to quality more rigorously followed than in the production of Wickwire Rope. That's because a quality rope is a safe rope. It helps the user eliminate losses due to injuries or wrecked equipment that can result when a "bargain" rope fails.

Wickwire Ropes are available in a complete range of sizes, constructions and grades—including Wickwire Double Gray *extra*-improved plow steel rope for your extra high strength rope requirements.

For safety's sake, use a quality wire rope . . . buy Wickwire.

WICKWIRE ROPE

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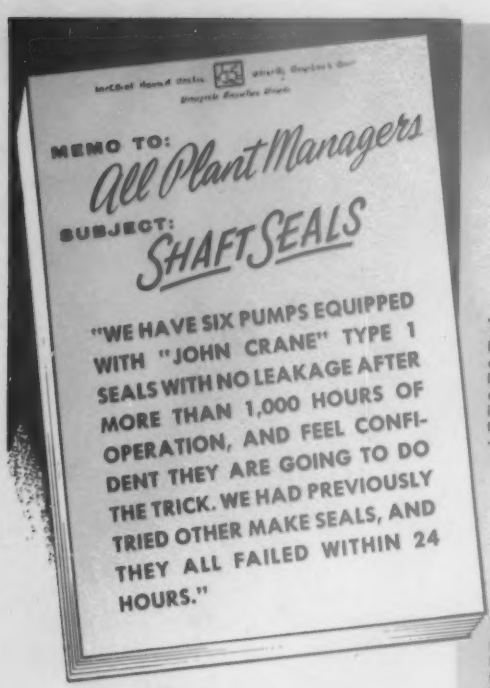
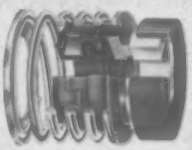

MEMO TO:
All Plant Managers
SUBJECT:
SHAFT SEALS
"WE HAVE SIX PUMPS EQUIPPED WITH "JOHN CRANE" TYPE 1 SEALS WITH NO LEAKAGE AFTER MORE THAN 1,000 HOURS OF OPERATION, AND FEEL CONFIDENT THEY ARE GOING TO DO THE TRICK. WE HAD PREVIOUSLY TRIED OTHER MAKE SEALS, AND THEY ALL FAILED WITHIN 24 HOURS."

John Crane®

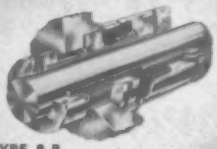
TYPE 1

Designed for limited stuffing box diameter. Handles water, light hydrocarbons, refrigerants, mild acids and other liquids non-injurious to synthetic rubber at temperatures from −40°F. to +212°F., pressures to 200 psi.



TYPE 2

Designed for limited stuffing box length. Handles same services, temperatures and pressures as Type 1.



TYPE 8-B

Heavy duty, high pressures. Packaged construction for easy installation. Handles pressures to 1200 psi., temperatures from −40°F. to +250°F. Services same as Type 1.

TYPE 9

Famous as a problem solver. Sealing members of chemically inert Du Pont Teflon. Engineered to service conditions to handle practically all destructive acids, corrosives and gases at temperatures from −120°F. to +500°F., pressures to 150 psi. Available in balanced construction for pressures to 750 psi.

This is part of an actual memo sent by one plant manager to others of the same company in different sections of the country—and that company is now exclusively specifying these and other type "John Crane" Shaft Seals for *all* their liquid handling requirements.

You too can save time, trouble and expense by doing likewise.

You'll find a "John Crane" Shaft Seal for every service . . . from hot or cold water to the most destructive acids and corrosives . . . high temperatures, high pressures . . . in types and sizes to meet practically any mechanical or dimensional requirement.

Send us details on your application. We'll recommend the proper shaft seal. Request Bulletin S-204-3 for complete overall information.

Crane Packing Co., 6419 Oakton St., Morton Grove, Illinois, (Chicago Suburb).

In Canada: Crane Packing Company, Ltd., Hamilton, Ont.

concern. However, I am unable to foresee appreciable margin increases for jobbers, dealers, or oil companies until we all come to the realization that our selling prices have not kept pace with our changing economic picture."

J. M. Shea, Jr., vice president for marketing, American Petrofina, in a speech to the Intermountain Oil Jobber Association.

Profits and progress

"The oil industry has served the nation well because it is a profitable industry.

"The word 'profit' has been much maligned of late. We need to remind ourselves that reward for accomplishment is a basic precept of a free society.

"The strides that have been made by American business in the twentieth century are due principally to the fact that there is a reward for effort in the form of profit."

H. S. M. Burns, president, Shell Oil Co., in an article in the August issue of Shell News, company magazine.

Letters to They Say should be addressed to The Editor, The Oil and Gas Journal, Box 1260, Tulsa, Okla.

CALENDAR

SEPTEMBER

9-11 American Society of Mechanical Engineers, American Society of Civil Engineers, West Coast conference of applied mechanics, Stanford, Calif.

9-11 Pacific Coast Gas Association, annual meeting, Ambassador Hotel, Los Angeles.

9-12 Intermountain Association of Petroleum Geologists, annual field conference, western high Uintas, registration September 9, Provo, Utah.

10-12 Magic Plains Oil Exposition, Borger, Tex.

14 American Petroleum Institute, University of Texas, seventh session of school of pipeline technology, Lee College, Baytown, Tex.

14-16 Texas Mid-Continent Oil and Gas Association, annual meeting, Rice Hotel, Houston.

15-16 American Gas Association, Southern Gas Association, eleventh annual accident prevention conference, Dinkler Plaza Hotel, Atlanta.

16-18 Wyoming Geological Association field conference, Big Horn Basin, registration, Cody, Wyo.

16-18 National Petroleum Association, annual meeting, Traymore Hotel, Atlantic City, N. J.

17 Natural Gasoline Association of America, Rocky Mountain regional meeting, Wyoming-Gladstone Hotel, Casper, Wyo.

17 American Gas Association, second annual pipeline research forum, Statler Hotel, Dallas.

17-18 International Seminar on Friction, Lubrication and Wear, Burgenstock, Switzerland.

18-19 Ardmore, Okla., Geological Society,

plan now for future piping extensions!

Welding extension to "8" line without shutdown of line. Pressure stopped off at dead end.

install **MUELLER**® *Extension Stopper Fittings*

H-17251 Extension Stopper Fitting for Dead End Extensions
Pressures to 230 p.s.i.
Sizes: 3", 4", 6" and 8"

■ **Plan ahead for future system expansion by capping all dead ends with Mueller Extension Stopper Fittings at the time the piping is installed.**

Then, when the line must be extended, just follow these four simple steps:

1. Stop-off line **at fitting** with Mueller Line Stopper Equipment. (No drilling needed!)
2. Cut off capped end of fitting.
3. Weld your new piping to fitting.
4. Remove stopper and "button up" fitting.

All of these steps are performed quickly and in complete safety. There is no interruption of processes on the existing line and no need to install expensive control valves.

Remember these fittings for your next piping installation. They will save you time and money when future extensions must be made.

Write for complete information on these and other sizes and styles of Mueller Extension Stopper Fittings.

NO-BLO®

These fittings are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller No-Blo product manufactured for the petroleum industry.

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DECATUR, ILL.

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

Fuller Pneumatic Conveying Speed Delivery,

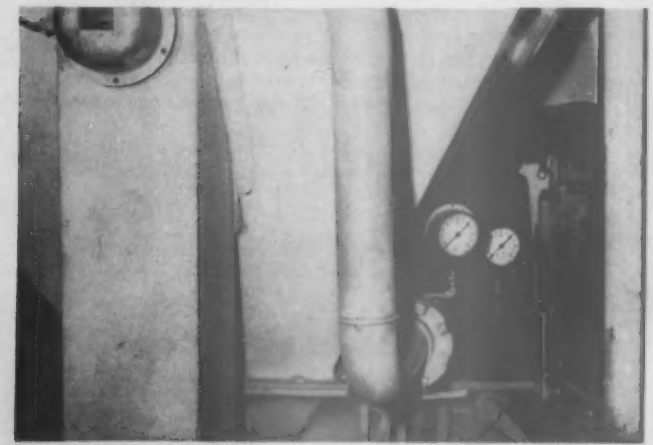
How Bourg Mud & Chemical Transfers

"C.T. 8" mud-delivery barge alongside drilling rig tender. Fast, pneumatic deliveries in high seas are made without danger to crews or equipment.

Superstructure of self-propelled drilling mud delivery barge, the "C.T. 8". Flexible hose, through which mud is pumped to rig storage bins at 50 tons an hour, rests atop enclosed Airslide bins. Pneumatic, bulk delivery system replaces cargo net, labor crew, costly bag handling.

Four of the eight bins discharging into Airslide® fluidizing conveyors in hold of "C.T. 8". These are discharged individually into a screw conveyor, as part of high-speed, automatic mud-delivery system.

Opening discharge gate at Airslide bin outlet, sending flow of dry drilling mud into screw conveyor.

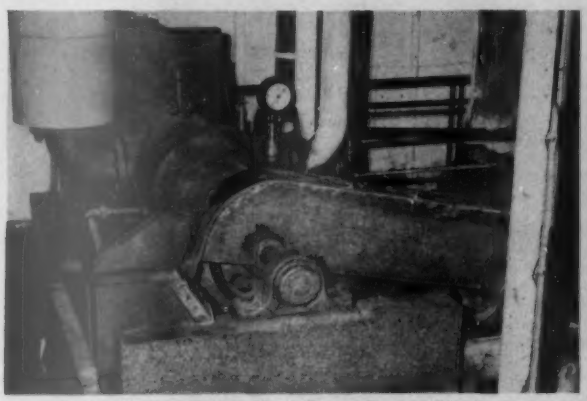


Pneumatic "Fluid Lift" elevates mud from screw conveyor discharge point into a receiving hopper—from which mud is pumped aboard rig.

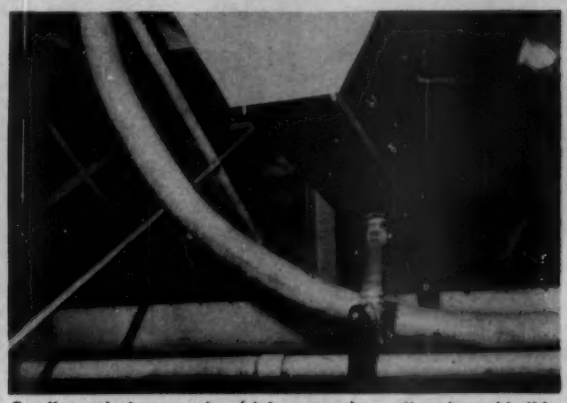
Bottom of receiving hopper, showing 6" Type "H" Fuller-Kinyon pump for pneumatically conveying barite. (Drive clutch in foreground.)

Systems for Drilling Mud Cut Labor Costs

50 Tons an Hour In Two-Man Operation

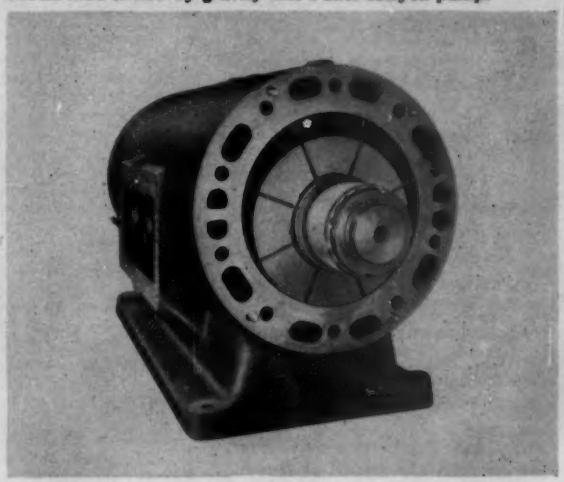


Rugged, trouble-free Fuller Single-Stage Rotary Air Compressor, located amidships, supplies all air for pneumatic conveying operations.



Small, vertical connection (right, center) supplies air to Airslide fluidizing conveyor along bottom of receiving hopper. This unit causes mud to flow by gravity into Fuller-Kinyon pump.

Mud-storage terminal adjoins dock. Fuller pneumatic conveying systems automatically move mud to weighing scale and then to either bulk cans or into bins of "C.T. 8" delivery barge. On both offshore and land-based rigs handling mud or cement, Fuller equipment offers time-tested advantages.



The Fuller Rotary Compressor—widely known in the petroleum industry for a variety of in-plant and gas-gathering applications. Advantages of the rotary include pulse-free compression, absence of vibration, low-power needs and reduction of maintenance. Available in capacities to 3300 cfm.

1321
G-205T

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pioneers in harnessing Air

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PRESSURE and TEMPERATURE RECORDERS

American® single and two-pen *Pressure Recorders* for pressures from 30 inches vacuum to 10,000 psi.

- Pressure elements individually calibrated over full range.
- Variety of chart drives available.
- Helical elements of different ranges are interchangeable.
- Stainless steel pen arms with span and linearity adjustments.
- Aluminum dust and moisture-proof case.

American® *Temperature Recorders* for an accurate record of flowing temperatures.

- No ambient temperature errors.
- High sensitivity and torque—fast speed of response.
- Standard 0-150°F. range. Other ranges available by request.
- 24-hour mechanical or 110-v. 60-cy. electric chart drives.

Ask for Bulletins 400 and 408

AMERICAN®
METER COMPANY
INCORPORATED (ESTABLISHED 1836)
General Offices: Philadelphia 16, Pa.
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field trip in southeastern and eastern Oklahoma, registration Sept. 17, Aldridge Hotel, McAlester, Okla.

20-23 American Society of Mechanical Engineers, petroleum mechanical engineering conference, Rice Hotel, Houston.

21-23 Texas Society of Certified Public Accountants, sixth annual institute on taxation, Houston.

21-23 Columbia University, oil refinery workshop on passive element analog computers, Engineering Building, Columbia University, New York.

21-25 Instrument Society of America, annual instrument-automation conference and exhibit, International Amphitheater, Chicago.

22-23 National Association of Corrosion Engineers, Shreveport, La., section, eighth annual corrosion control short course, Centenary College, Shreveport.

23-24 Western Petroleum Refiners Association, Rocky Mountain regional technical-industrial relations meeting, Henning Hotel, Casper, Wyo.

24-25 Mid-Continent Oil and Gas Association, Louisiana-Arkansas division annual meeting, Roosevelt Hotel, New Orleans.

27-29 National Association of Oil Equipment Jobbers, annual convention and trade show, Hotel Leamington, Minneapolis.

27-30 American Institute of Chemical Engineers, national meeting, Hotel St. Paul, St. Paul.

29-30 Western Petroleum Refiners Association, management seminar, Western Hills, Wagoner, Okla.

28-Oct. 1 American Welding Society, fall meeting, Sheraton-Cadillac Hotel, Detroit.

29-Oct. 1 National Association of Corrosion Engineers, western region conference, Bakersfield Inn, Bakersfield, Calif.

OCTOBER

1-2 National Association of Corrosion Engineers, southeast region conference, Jacksonville, Fla.

2-3 Association of Desk and Derrick Clubs of North America, eighth annual convention, Hilton Hotel, San Antonio, Tex.

4-7 Society of Petroleum Engineers of AIME, fall meeting, Memorial Auditorium, Dallas, Tex.

5-7 American Gas Association, annual meeting, Conrad Hilton Hotel, Chicago.

5-7 National Association of Corrosion Engineers, northeast region conference, Lord Baltimore Hotel, Baltimore.

5-10 Society of Automotive Engineers, national aeronautic meeting, aircraft engineering forum, and aircraft engineering display, The Ambassador, Los Angeles.

7-8 Western Petroleum Refiners Association, fourth annual stream pollution and waste disposal conference, Broadview Hotel, Wichita.

7-10 Rocky Mountain Association of Geologists, eleventh annual field conference, Saratoga Inn, Saratoga, Wyo.

8-9 California Natural Gasoline Association, annual fall meeting, Huntington-Sheraton Hotel, Pasadena, Calif.

8-10 American Association of Petroleum Geologists, Southwestern Federation of Geological Societies, second annual regional meeting, Coliseum, Lubbock, Tex.

8-10 Exploration Drilling symposium,

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8-11 Louisiana Gulf Coast Oil Exposition, Lafayette, La.

11-13 American Association of Oilwell Drilling Contractors, annual meeting, Skirvin Hotel, Oklahoma City.

11-16 American Society for Testing Materials, Pacific area national meeting, Sheraton-Palace Hotel, San Francisco.

12-15 National Association of Corrosion Engineers, south central region conference, Cosmopolitan Hotel, Denver.

13-14 Seventh Annual Gas Measurements Institute, National Guard Armory, Liberal, Kans.

16-17 University of Texas, E. P. Schoch lecture series, process control, University of Texas, Austin.

20-22 American Standards Association, national conference on standards, Sheraton-Cadillac Hotel, Detroit.

20-22 National Association of Corrosion Engineers, north central region conference, Cleveland.

20-22 American Society of Mechanical Engineers, American Society of Lubricating Engineers, lubrication conference, Sheraton-McAlpin Hotel, New York.

22-23 American Institute of Mining, Metallurgical, and Petroleum Engineers, Los Angeles Basin section, fall meeting, Huntington Sheraton Hotel, Pasadena, Calif.

23 Natural Gasoline Association of America, southern regional meeting, Carlton Hotel, Tyler, Tex.

26-27 Independent Petroleum Association of America, annual meeting, Statler-Hilton Hotel, Dallas.

26-27 Independent Natural Gas Association of America, annual meeting, Westward Ho Hotel, Phoenix.

26-28 Society of Automotive Engineers, national transportation meeting, La Salle Hotel, Chicago.

27 American Institute of Chemical Engineers, New York section, technical symposium, Hotel New Yorker, New York.

28-29 Western Petroleum Refiners Association, annual question and answer session on refining technology, Rufus Garrett Hotel, El Dorado, Ark.

28-29 Armour Research Foundation of Illinois Institute of Technology, annual computer applications symposium, Morrison Hotel, Chicago.

28-30 Society of Automotive Engineers, fuels and lubricants meeting, La Salle Hotel, Chicago.

28-30 American Association of Petroleum Geologists, Mid-Continent regional meeting, Broadview Hotel, Wichita.

29-30 Oil Recovery Symposium on Southwest Texas, sponsored by southwest section of AIME and Texas Petroleum Research Committee, Driscoll Hotel, Corpus Christi, Tex.

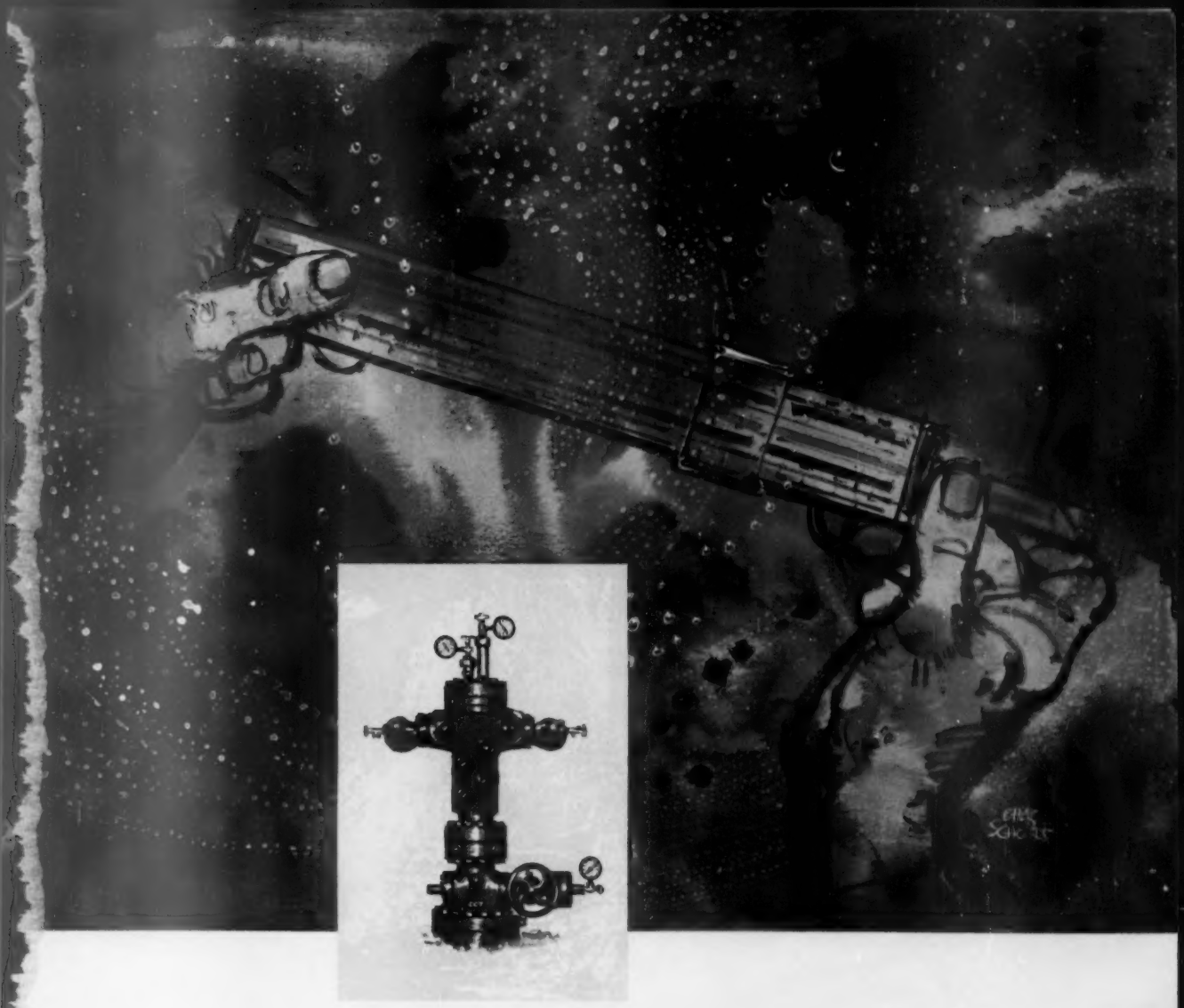
NOVEMBER

4-6 Rocky Mountain Oil and Gas Association, fourteenth annual convention, Brown Palace Tower, Denver.

4-6 Institute of Radio Engineers, national automatic control conference, Sheraton Hotel, Dallas.

9-10 National Academy of Sciences-National Research Conference, first international symposium on fire research, National Academy of Sciences, Washington.

9-12 Society of Exploration Geophysicists, twenty-ninth annual meeting, Biltmore Hotel, Los Angeles.



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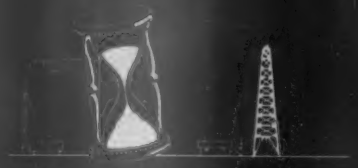

JOURNALLY SPEAKING

50 years ago

September 6, 1909

J. Edgar Pew, manager of Sun Co. of Texas, Dallas, is in Tulsa looking over oil prospects in Oklahoma with a view toward his company getting into the play in this state. Sun until now has been getting all its crude supply from Gulf Coast fields, both as producer and buyer.

Hard luck hits Hoskins Mound field in Brazoria County, on the Texas Coast, for the second time within 2 months. Barely recovered from a severe hurricane late in July which leveled all derricks and other surface equipment, the field last week was swept by a prairie fire. Five large wooden oil-storage tanks, a newly rebuilt boiler house, and a derrick were destroyed. The following day, high winds wrecked another derrick.

25 years ago

September 6, 1934

Northwest Co., Ltd., operating subsidiary of Imperial Oil, Ltd., joins Hudson's Bay Oil & Gas Co. in exploration and development of the latter's extensive potential oil and gas acreage holdings in Western Canada.

Standard Oil Co. of California's tanker El Segundo returns to home port of San Francisco after memorable 8-month round-trip voyage to Bahrain Island in the Middle East. Returning, it carried the first cargo (25,000 bbl.) of crude ever loaded at Bahrain Island. This was unloaded at Yokohama, Japan, except for a few hundred barrels brought to Los Angeles for analysis and testing at the Richmond refinery.

10 years ago

September 8, 1949

Standard Oil Co. of California's 5 Mushrush well in Wasco field, Kern County, California, becomes the world's deepest oil producer. From Eocene sand at 15,440-75 ft., it flowed 96 bbl. of 40.7°-gravity oil and 480 M.c.f. of gas per day.

The first string of all-plastic tubing ever used by the petroleum industry is run by National Cooperative Refining Association in a salt-water-disposal well on its Harbarcck lease in the Ellinwood area of Ellsworth County, Kansas. The string consisted of 3,387 ft. of 2½-in. extra-heavy threaded pipe.

Record high bottom-hole pressure of 12,635 psi. is recorded by Tidewater Associated Oil Co. in the completion of its 1 State Lease 1299 well at Manila Village, 25 miles south of New Orleans, in Jefferson Parish, Louisiana. Well flows 157 bbl. of 38°-gravity oil through 3/32-in. choke from sand at 12,994-13,050 ft.

Pound of Flesh

PORTIA, Shakespeare's famous lady lawyer, ought to run for election to the Texas Railroad Commission, or maybe the Texas Supreme Court.

There's a dilly of a lawsuit pending there that rivals the legal perplexities, if not the human drama, of the trial in the "Merchant of Venice." No human body is being sliced up—just an oil field. But the laws pertaining to the slicing seem quite similar in both cases.

You recall that in Shakespeare's classic, Shylock had the legal right to cut a pound of flesh from the person of Antonio who had the misfortune to be on the wrong end of a foolish but valid contract.

But in a brilliant courtroom scene Portia saved her client by invoking a superior law which prohibited Shylock from shedding a drop of Antonio's blood, and so the contract was unenforceable.

There was also a love triangle and a lot of moaning about daughters and ducats which the master playwright wove into his drama. The Texas case doesn't have any love angle and so probably won't become such popular reading. But it involves plenty of ducats, and the legal issue could develop into as big a classic of jurisprudence as Portia's case.

There's a law in Texas that a man has a right to drill an oil well on his own land. That would seem to be fair enough. There's also a law (or maybe its technically just a regulation or an established custom) that a well should be allowed to produce enough to pay for itself if it can. This also seems quite reasonable.

But Texas also has a law against stealing.

These laws have run into a head-on collision in an oil and gas field down near Port Arthur. The Texas Railroad Commission ruled that this field should be developed by drilling only one well on each 160-acre tract. So a group of Antonios, who owned big tracts, began doing this.

Then along came some Shylocks (and we use the term simply to maintain the Shakespearean parallelism) who owned little bitty tracts. They told the commission that they had the legal right to drill one well on each, and the commission 'lowed as how they were right and promised to give them big enough allowables to pay out.

This put the Antonios in a bind. They claimed that the little tracts don't have enough oil and gas under them to repay the cost of drilling, and that the only way the Shylock wells can make their promised allowables is by stealing from the adjoining tracts owned by the Antonios.

So they have hired some Portias, and are headed for the Texas Supreme Court.

Apparently the Texas Portias are not going to challenge the right of the Shylocks to their pound of flesh, i.e., their right to drill a well on their own land.

But they maintain that in getting the pound of flesh they can't shed a drop of blood—meaning that they can't drain away any Antonio oil or gas—because that would be stealing and the law against stealing stands in the way of letting the Shylocks collect on their rights.

If you insist on being technical, the word "stealing" doesn't appear in this case any more than "flesh" or "blood." The Texas wearers of Portia's mantle use such legal niceties as due process of law and protection of correlative rights.

But the analogy seems pretty close.

Will Shylock get his pound of flesh? Will Antonio lose a drop of blood? Will Portia find a way out?

Keep tuned to the Texas courts and follow the outcome of this thrilling drama.

Thrilling drama or not, it's a serious and highly important matter to the oil industry in Texas and elsewhere. The case involves some fundamental issues which may greatly affect the future course of conservation.

That's why the final decision may be as much a legal classic as Portia's case.

—Henry D. Ralph.

Background: *Compressing isobutane in refrigeration system of alkylation plant of Petro-Tex Chemical Corp.* **Foreground:** *Cutaway of high-pressure seal of Cooper-Bessemer Type RD Centrifugal Compressor.*

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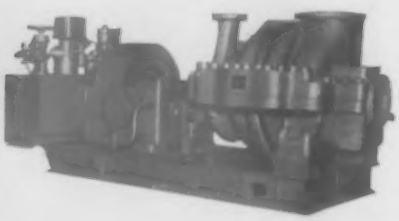

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John Fullemann, *Chief Turboproduct Design Engineer, right, and* Kenneth Stevenson, *Turboproduct Designer, The Cooper-Bessemer Corporation, discuss...*

How reliable Cooper-Bessemer Centrifugal Compressors aid 'round-the-clock processing

For example, here's the picture at Petro-Tex Chemical Corp., Houston: The entire sulfuric acid alkylation plant banks on the dependable performance of the Cooper-Bessemer Type RD Centrifugal Compressor which handles isobutane for refrigeration. This unit operates on a continuous, 24-hour basis, handling 11,125 cfm and boosting pressure from 16.2 to 98 psia. Its constant availability is a must.

Of course, many things go into Cooper-Bessemer centrifugals to assure this kind of reliability. For example, take the two-sleeve oil film type seals shown in the illustration. This Cooper-Bessemer design is capable of sealing against pressures of more than 1000 psi, for utmost dependability in processing service.

Bear in mind, too, that the performance of Cooper-Bessemer equipment is backed by an unsurpassed service organization to help protect your plant investment and assure optimum operating economy. For further information, call our nearest office.

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Attacks on FPC won't solve the gas problem

GAS PRODUCERS have many complaints against the Federal Power Commission, but they should rise to defend it against the snide and unwarranted criticisms in a current business magazine.

That article suggests that four of the five commissioners should resign because they think the Natural Gas Act is not suited to producer regulation. It charges them with nonfeasance in permitting some gas prices to rise, and demands an immediate crackdown on field prices.

It accuses producers of evading regulation by selling gas in intrastate markets, by withholding or failing to develop new reserves, and by asking higher prices. And it implies that such things are illegal and have been achieved by connivance of FPC.

THIS REFLECTS THE PUNITIVE and dictatorial attitude toward producers that featured the first congressional debate on the Harris bill. Its revival now shows that the industry made a big mistake in dropping its program of public education when that bill was vetoed.

FPC has been slow and vacillating in its approach to producer regulation. But that is not due to any conspiracy with producers to evade the law or force Congress to modify it.

It is caused by FPC's appreciation of producers' legal rights and economic posture, and its intimate understanding of the great and innumerable problems of applying to them a totally inappropriate formula designed for an entirely different type of business.

It is not FPC that has created the "confusion bordering on chaos" that exists in the natural-gas industry. Nor is it the recalcitrance of producers. It is the collision of theory with reality.

Chaos would be created if FPC were to bull through with arbitrary price orders in the fashion urged by advocates of strict regulation blind to the economic and legal consequences involved. This is evident, as one illustration, in the way in which gas purchasers are objecting to the utility type of rate making proposed in the Phillips case.

THE WAY OUT OF THE CONFUSION is for producers to help FPC grope through the regulatory maze. Without putting their heads in a noose they can submit evidence justifying FPC in taking some bold new tacks in its decisions.

Everything will be appealed to the courts, of course, and for a while the confusion may be greater. But in the end the courts will either demonstrate that Congress should revise the law, or the courts will themselves write that new law a piece at a time.

FPC has a thankless job, but what it needs is more friendly help and less abusive criticism. Practical suggestions from men in the business will move it more than lambastings from uninformed theorists.

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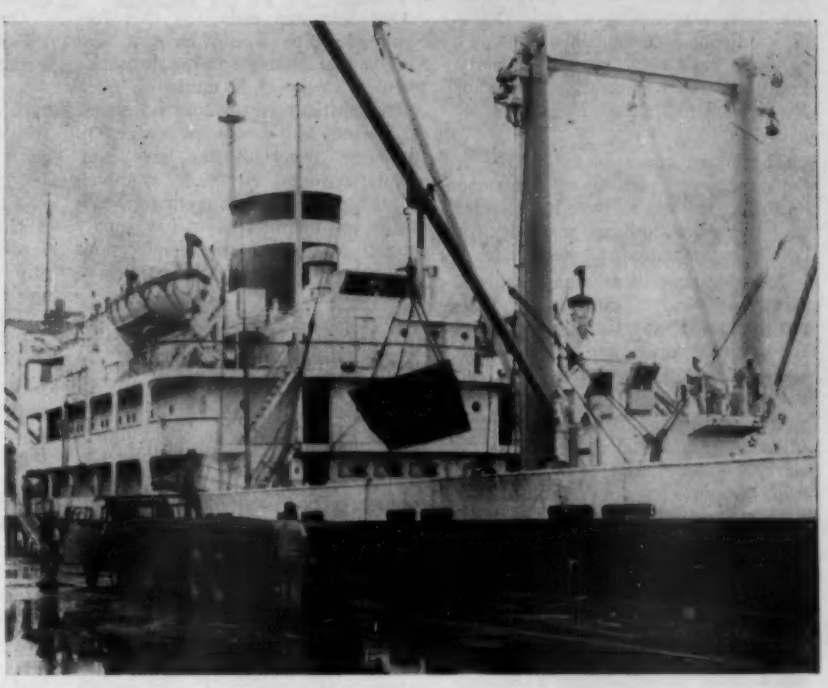


JAPANESE STEEL is being unloaded from a freighter at the port of Houston. Imports of foreign steel this year have picked up considerably at Houston, but foreign-made tubular goods still aren't making much of a splash in the oil industry.

Oil So Far Escapes Steel Shortages

• Stocks held by companies and suppliers have proved adequate to meet all industry's needs. Picture will start changing after this month if strike unsettled. Foreign steel supplies prove only minor factor.

SALESMEN of foreign pipe and tubular goods aren't exactly making a killing off the current steel strike.

They're having some trouble peddling their wares to the oil industry. And strangely so are some of their American counterparts.

The reason: Serious shortages of oil-country steel have failed to develop so far. Oil companies say they have had plenty of steel in their inventories to do necessary drilling. And supply houses say they have been able to meet the steel needs of their customers — both independent and major alike.

This explains why salesmen of both foreign and domestic steel goods report about normal sales to the oil industry. There's no frantic buying. So far everyone's needs have been met.

How long can this last? Consensus among company purchasing agents and supply people interviewed by editors of The Oil and Gas Journal over the country is that pinches will start being felt by October if the strike remains unsettled that long.

Some larger companies report they have enough steel on hand to last out the rest of the year.

Foreign headaches . . . Two other factors also help explain why foreign steel isn't flooding into the oil country.

Foreign salesmen can't:

. . . **Quote** cut-rate prices.

. . . **Promise** quick delivery.

One of the chief attractions of foreign steel was removed shortly after the steel strike began when foreign mills increased prices. American steel men say this is an old story—prices on foreign goods always go up when domestic steel is short.

The foreign steel salesmen, however, claim the price increases reflect inflationary conditions existing in their homelands. They say there is not a surplus of steel at home. Much of the steel which normally would find its way into export channels is being sent to domestic users.

The foreign salesmen at present usually can promise delivery in only from 5 to 6 months on spot sales. This is a handicap because most buyers expect the steel strike to be settled and production nearly normal by the time they could get delivery on foreign steel.

This general situation was confirmed by spokesmen for Mitsuibishi International Corp., the Japanese firm which opened a Houston office recently. He said: "We haven't received any great rash of inquiries on tubular goods. Haven't sold any. Prices have crept upward on Japanese steel, but they were going up in early spring all over the world. The rise doesn't have anything to do with the strike. Our prices may be a little higher."

Houston manager of Ataka, another Japanese firm, reported his company had just started its line-pipe business and could not tell exactly how much the strike had helped. He said the demand for tubular goods was quite brisk.

"One trouble is rising prices," he said. "This is due to an increase in the Japanese domestic market rather

than the steel strike. Prices on tubular goods are around 10% above what they were a month or so ago. Deliveries on spot orders taken today can't be made until early January or early February. This is quite a handicap. Everyone is looking for immediate delivery."

The Ataka company is looking at the long-range picture of American business. It aims to base its business on lower prices and better quality for both tubular goods and steel plate.

Most Houston-based manufacturers, fabricators, and oil companies admitted to buying very little foreign steel for domestic operations. Those with activity abroad use foreign steel in those projects.

But an official of Sheffield Steel plant at Houston gives another view of the general steel business. He said, "Imports have very seriously cut into our business. More than 300,000 tons came in the first 5 or 6 months of this year at Houston. Prices were lower then, but now that the strike is on, some items have gone up above domestic prices."

Stockpiling . . . Southern California oil men soon may be able to buy Japanese line pipe "off the shelf."

Atlas Commercial Corp., North Hollywood, has a tieup with Nippon-Tokushu steel mills to supply the American oil industry with API-standard line pipe. Atlas is stockpiling all types of such pipe and expects to start selling soon at prices from 5 to 10% below comparable domestic pipe.

The West Coast representative of Asahi New York, Inc., big importer of Japanese heavy items, reported his firm was not active in oil field pipe business. He said domestic demand was not sufficient to attract them.

The Asahi spokesman also said the domestic demand for steel in Japan right now is so large that the mills had no large surplus for exports.

American Mannex Corp., big German steel combine with mills over the world, reported the American steel strike so far had not boosted its West Coast business. An upturn is expected, however, if the strike lasts through September.

The Mannex official, like the Japanese, said that demand for steel is so strong in Europe that the pressure isn't so great to sell surplus production abroad. He reported this big change has occurred within the past 4 or 5 months.

The foreign salesmen agree that they have a difficult job peddling their steel goods in competition with American items. They say it's difficult to talk quality—their main wedge is price.

One salesman estimated that foreign-made pipe would have to sell 35% under domestic pipe to make any dent in the U. S. market.

This difficulty in selling is reflected in the Mid-Continent area. Oil companies reported they have been circularized and visited by salesmen of foreign goods. The companies still prefer to maintain their old supply sources and will buy foreign goods only in a pinch or if price is unusually attractive.

The domestic outlook . . . Over-all supply of tubular goods has proved adequate so far but shortages are beginning to be felt in certain items.

The pinch now is in small-dimension goods for slim-hole drilling and high-strength steel tubing for deeper drilling. The small-dimension stuff has never been too plentiful, and suppliers or operators usually don't stock too much of the high-strength material.

One big supplier reports only a few smaller operators have shut down and these may have run short of capital as much as supplies. The bigger operators still have not curtailed operations with the possible exception of their offshore work. Here too the slowup is caused by other factors.

Most of the majors on the Gulf Coast report their steel stocks are adequate to run well into November without any trouble and even longer with some swapping around.

One major, however, has stepped up its drilling program since the strike began and is running into shortages in certain sizes and kinds of pipe. The main shortage is in deep-well tubular goods. This company expects no serious trouble because it has regular supply sources abroad and can supplement domestic steel.

On the West Coast the majors and leading independents indicated they still are in good shape on steel. Comments on when pinches would develop ranged from 45 days to the end of the year.

One major which had ordered a little heavy in anticipation of the strike reported its supplier still was making deliveries to the point that the company was getting more steel than it actually needed.

Mid-Continent operators also have not been hampered by lack of steel and will be able to operate through October without trouble.

Some suppliers and purchasing agents in the midlands believe the actual steel pinch may hit the industry in the first quarter of 1960.

They reason that by the time the strike is settled and plants are back in production a full quarter of production will be lost. It also will take time to fill the distribution pipeline with a variety of items. During this interim some real shortages could develop.

watching WASHINGTON

Clyde La Motte

Winning friends and influencing Congress . . .

THE COAL INDUSTRY has been aggressive in Washington this summer, and the eventual impact on oil could be considerable.

Coal people have talked Congress into approving a giant coal research and development program. And they appear to be making headway toward establishment of a joint congressional committee to draft a national fuels policy.

The research project, to be paid for by the Government, would be aimed at developing new uses for coal, expanding old uses, trimming coal costs, and in general making coal more competitive with other energy sources—mainly oil and natural gas, of course.

The coal people aren't talking about small-scale, technical research projects, such as the Bureau of Mines already does. They envision really big goals, such as an all-out drive to make oil from coal competitive with petroleum.

Peace Moves Continue

. . . in refinery strikes. El Dorado workers turn down Amoco offer—it could have set company-wide pattern.

NEGOTIATIONS resumed last week in efforts to end strikes at American Oil Co. refineries in El Dorado, Ark., and Texas City, Tex.

Hopes for settlements with locals of the Oil, Chemical and Atomic Workers International Union dimmed. Bitterness made progress difficult.

Amoco submitted a plan to settle the 2-month-old walkout at El Dorado. Union members, however, declined to accept the offer and thus forced representatives to continue negotiating.

Details of the plan were not revealed either by the company or union, but its acceptance would have set a pattern for settling both the Texas City dispute and a similar one with the OCAW at the Sugar Creek, Mo., plant of Standard Oil Co. (Ind.), parent company of Amoco.

Prior to the union turndown, both Amoco manager H. A. Heiss and OCAW Negotiator T. A. Hoffman expressed hope for securing an early settlement of the dispute.

Union spokesman said, later, the Amoco offer represented an improvement in the job classification clause. He said the "company seems willing to bring the union into the classification field in a substantial way."

Tension . . . Bitterness surrounded renewed bargaining sessions in the Texas City strike.

The company said it had the names of more than 100 strikers who are ready to return to work. The union in general scoffed at the back-to-work movement.

Management held off announcing when it would call in the 100-plus workers to make good on their pledge to man their posts again. When, and if, this does occur, it will be a tense moment when the workers first cross the picket line.

The OCAW has denied any intention of violence, although its officials say any blame for trouble must be laid at the company's door.

Tension mounted last week as an aftermath to the mysterious beating of one back-to-work advocate, Fritz Schultz. Schultz was hospitalized after being attacked by several men.

The company subsequently offered rewards of $5,000 for a felony conviction and $1,000 for a misdemeanor conviction of any person doing bodily harm to a company employe or his family.

The issues in the Texas City strike, like those at El Dorado and Sugar Creek, remained the same. The union seeks a change in the now-expired work contract. It wants to restrict management's authority in prescribing work to be performed under job classifications set up 2 years ago. Management wants the continuing right to change work assignments as needed.

Other activity . . . In other developments across the country:

. . . Judge Richard C. Jensen fined the Sugar Creek local and OCAW international $1,000 each on contempt charges stemming from recent union picketing. Fine was levied in Jackson County Circuit Court in Kansas City.

. . . Whiting, Ind., city council passed an ordinance regulating operation of industrial plants during strikes. It stipulates that persons operating units during a strike shall have 2 years' experience. Ordinance was proposed during recent strike, was backed by union, and opposed by management.

. . . Many Chicago service station operators are signing new contracts with Teamsters calling for 40-hour week for all drivers and attendants. Pay will remain same as for 48-hour week.

The plan is rapidly moving past the talking stage. Congress has approved and sent to the White House legislation authorizing the establishment of a coal research and development commission.

This will be an independent government agency, although it will be placed in the Interior Department for administrative purposes.

It will have three commissioners, appointed by the president, and a research director to head a research staff. A $2,000,000 budget has been proposed for the first year, just to get the agency started.

How to shape a national fuels policy . . .

THE SECOND GOAL of the coal drive—to get a special congressional committee established to draft a national fuels policy—is not as far advanced as the first. Resolutions have been introduced in each house, but final action may be delayed until next year.

In the long run, the fuels policy plan could have even more significance than the research commission. Since coal-state congressmen are the ones pushing for a policy committee, it is natural to anticipate that coal-state congressmen would have a strong voice in the actual policy making.

It could give fresh impetus to long-standing coal efforts to limit uses of natural gas and to make restrictions on residual oil imports even stricter. And it could shape legislation that would have many direct or indirect effects on oil and gas.

The sudden increase in the Government's interest in coal's welfare isn't just a happenstance. It is the result of a well-organized and well-publicized campaign by the coal industry, by coal-hauling railroads, coal equipment manufacturers, and the politically powerful coal unions.

The coal industry figures that the Government is going to play an increasingly big role in shaping the future of the energy industries. And it wants to make sure that Congress deals it some winning cards.

A sequel to the Romanian oil shipment . . .

IF ANY MORE Romanian oil is shipped into the U. S., the Treasury Department plans to know about it, pronto.

You will recall that Treasury was asked last fall to investigate the shipment of some residual oil from Rumania. It did so, and last week dutifully reported that it could find nothing legally amiss. That is, it could not ascertain that the fuel was dumped here at an unfair price (by Romanian standards) or that there was any slave labor or other banned practice involved.

However, a Treasury spokesman concedes privately that by the time the investigation had gotten under way, most of the "evidence" was gone. So now Treasury has alerted customs officers to let it know at once if a shipload of oil from that country appears in a U. S. port.

Jersey to Merge Humble, Carter, Esso

• Humble to be surviving company in long-talked Jersey move to consolidate its domestic operations. Change won't be imminent; some officials estimate 2 years will be required to effect the merger.

What the merger will pull together

Refining barrels per calendar day

Humble	
Baytown, Tex.	283,900
Esso Standard	
Baton Rouge, La.	364,200
Everett, Mass.	50,000
Baltimore, Md.	16,500
Bayonne, N. J.	25,000
Linden, N. J.	168,000
Charleston, S. C.	11,440
Carter	
Billings, Mont.	33,950
TOTAL	952,990

Production barrels daily

Humble	301,400
Carter	74,325
TOTAL	375,725

Service Stations

Humble	2,973
Carter	596
Esso	17,427
Pate and Oklahoma	1,082
TOTAL	22,078

*Figures as of January 1, 1959.

THE long-talked merger of Humble Oil & Refining Co. and Carter Oil Co. last week was finally under way.

The parent company, Standard Oil Co. (N. J.), went industry gossips one better and also included Esso Standard Oil Co. and two small marketing subsidiaries, Oklahoma Oil Co. and Pate Oil Co.

If and when the merger is accomplished, it will mean one giant domestic company which will handle all of Jersey's exploration, production, refining, and marketing activities. Humble will be the surviving name, but the new company will be incorporated in Delaware, rather than Texas.

Research will continue to be handled under separate subsidiaries, Esso Research & Engineering Co. and Jersey Production Research Co.

Headquarters of the consolidated company will be in Houston.

Late in July, Humble announced plans to build a 44-story office building costing $32,000,000 in downtown Houston (OGJ, Aug. 3, p. 47).

The building probably will be started in 1960 and completed in 1962.

The new company . . . The merger will put together an integrated domestic company with these features.

. . . **Production** of more than 375,000 bbl. daily in 23 states. Humble operates about 17,000 wells in eight states, and Carter has about 4,000 wells in its 15-state operating area.

. . . **Refining** capacity of more than 950,000 bbl. on a calendar-day basis. The merger will pull together under one command Humble's Baytown, Tex., refinery, Carter's Billings, Mont., refinery, and Esso Standard's five refineries at Baton Rouge, La.; Everett, Mass.; Bayonne and Linden, N. J.; and Baltimore.

. . . **Eighteen** field-processing plants. Humble has an interest in 11 more.

. . . **A marketing** organization which will be the biggest in the U. S. and which is still expanding. The five Jersey marketing subsidiaries were operating 22,078 service stations at the beginning of this year.

. . . **A pipeline system** of about 5,700 miles of crude-oil trunk lines and 3,000 miles of gathering lines, plus a 276-mile products line.

Not included in the merger will be Interstate Oil Pipe Line Co., which is a wholly owned subsidiary of the parent Jersey Standard. Interstate has more than 3,000 miles of trunk and gathering lines in six states.

Reason: Efficiency . . . The world surplus of crude oil, at low prices, and the intense competition within the oil industry forced the change, according to one Jersey official.

"When you have a surplus as we have now, and when your competitors are moving to streamline their organizations, as they are doing, you just have to become more efficient," he said.

Another reason given was the growth of the various subsidiaries. These once operated with a lot of elbow room but, as the industry developed, have found themselves rubbing shoulders with their affiliates.

The Jersey consolidation parallels that of one of its major competitors—Socony Mobil Oil Co. Socony recently anounced it is consolidating all of its domestic operations, including those of Magnolia and General Petroleum, under one company—Mobil Oil Co. (OGJ Aug. 17, p. 104).

No change now . . . Jersey officials emphasized that there will be no immediate change in domestic operations.

"The lawyers will have a field day for a number of months" before merger details can be worked out, one said.

After that, and perhaps for an indefinite period, Esso Standard and Carter will continue to operate under their own names as divisions of Humble Oil & Refining Co.

One official estimated that it might

be as long as 2 years before any significant realignment occurs.

One brand name? . . . The merger of five marketing companies should make it easier for Jersey to realize a wish for many years: A nationwide marketing setup under one brand name.

The company has long been irked by the fact that while it is the nation's biggest marketer, it has never been able to conduct a nationwide promotion program of its products.

Under the 1911 decree dissolving the Standard Oil Trust, the present Jersey company was prevented from use of the Standard name in areas where it competed with other Standard Oil companies such as Standard of Indiana, Standard of Kentucky, and Standard of California.

In a few states it does not yet market under any name. In recent years, however, it has been moving to extend its marketing operations in what appears to be a calculated move to become a coast-to-coast marketer.

Carter has gradually extended its marketing operations westward until it now has reached the Pacific Coast (see map). Humble, in the South, has also been moving westward. Only this summer it pushed into Arizona with the purchase of a large number of independent service stations.

Carter's background . . . Carter Oil Co. was formed in 1893 in Sistersville, W. Va., by Col. John J. Carter.

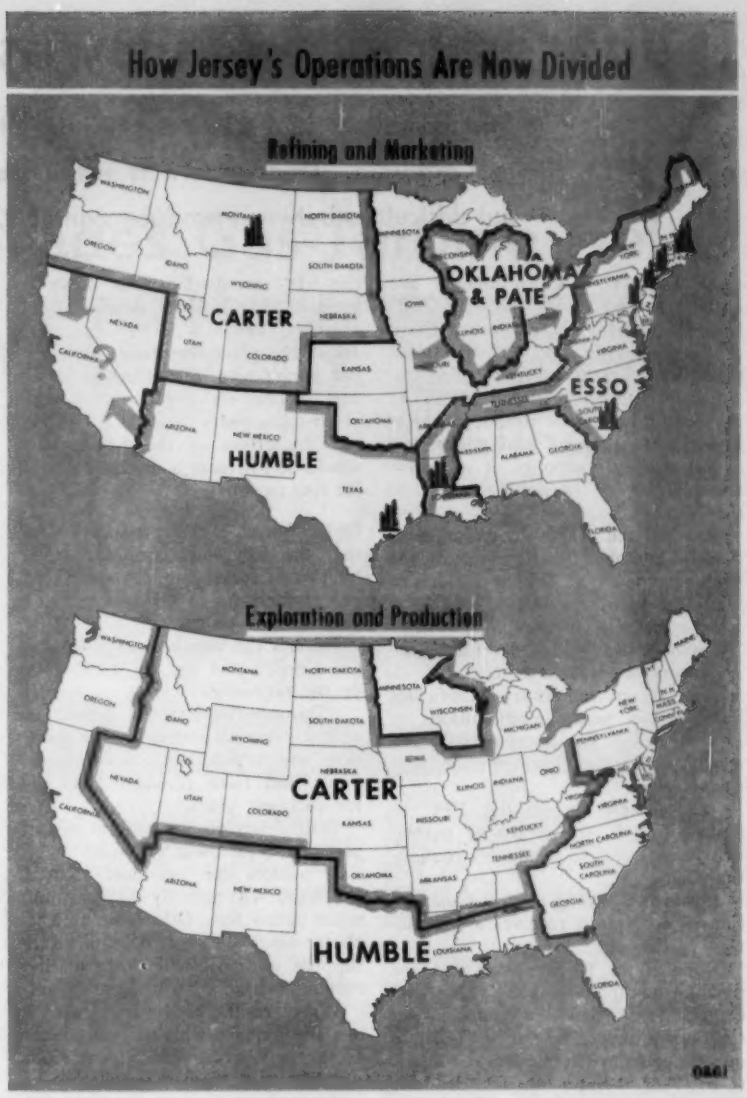
The company was bought by South Penn Oil Co., a Standard affiliate, when it was less than a year old. Carter retained its name and continued its drilling and producing activity in West Virginia, Ohio, and Pennsylvania.

In 1913 Carter opened district offices in Tulsa and purchased producing leases in Oklahoma and Kansas. The company headquarters were transferred from Sistersville to Tulsa in 1915.

The company did extensive exploration work in Montana and Wyoming beginning in 1922 and later expanded its oil search to Illinois, Indiana, Arkansas, northern Mississippi, Louisiana, and Colorado.

It first entered the manufacturing and marketing field in 1944 with purchase of four companies in Montana and Wyoming. The companies had refineries and their own marketing organizations, plus production.

Carter eventually sold three of the refineries at Lovell and Newcastle, Wyo., and Cut Bank, Mont. It operated a 4,000-bbl. refinery at Billings, Mont., until 1949 when it opened a new $25,000,000 plant in Billings, dismantling the original plant.



The Humble story . . . Humble was born in 1917 when a group of about 25 independent operators with $8,000,000 in properties decided to pool their interests.

They were motivated by their inability to sell oil at a price they felt they should get. One trouble was that they could not guarantee shipments to eastern refineries.

They formed the company on March 1, 1917, by oral agreement.

The first president was Ross S. Sterling, later governor of Texas. The Humble name came from the small town of Humble, Tex., site of an oil field found in 1906.

The company started out with about 7,000 bbl. daily of production at Goose Creek, South Lake, and Batson fields in South Texas and in Wichita County in North Texas. Its "refinery" at Humble had a capacity of 300 bbl. daily. Its pipeline system consisted of 3 miles of gathering lines at Goose Creek.

When the year was out, production had risen to 13,000 bbl. daily, and plans soon were made to build a refinery in a rice field that was to become Baytown.

The company had 541 employes at the close of 1917.

Today Humble has more than 17,000 employes and assets of more than $1.5 billion.

Jersey Standard bought a half interest in the young Humble company in 1919 for $17,000,000.

In private deals it added to its interest and by 1954 had acquired about 72% of the stock. In stock exchanges it later added another 18% or so, and last year brought its Humble holdings to 98.27% through an offer of five Jersey shares for four of Humble.

Producers Fight Transwestern Ruling

• Stiff conditions laid down by FPC are attacked by suppliers of big line to California. Transwestern is seeking early date for hearing to iron out difficulties between producers and FPC.

NATURAL GAS producers are balking over the "unprecedented" conditions the Federal Power Commission has attached to their contracts with Transwestern Pipeline Co.

Transwestern is urging the FPC to act promptly on the producer objections. The company said that unless it has their gas supplies, it will have to abandon its proposed service to California.

It asked the agency to set an early date—September 9, if possible—for oral arguments or for a conference with the interested parties.

In a petition filed with the FPC, Transwestern said that several of the producers have indicated they are willing to accept temporary certificates with certain minor modifications of FPC's terms. The company did not specify the exact changes the producers want.

Transwestern urged the FPC to issue promptly temporary or permanent certificates to producers requesting them.

It said it is willing to start construction as soon as it receives a satisfactory certificate.

None of the 14 producers and one pipeline company involved has accepted the downward revisions in initial rates proposed by the FPC. These cuts range from 1 to 6 cents per M.c.f. (OGJ, Aug. 17, p. 94). The deadline for accepting the price conditions was August 31.

Instead of accepting, the producers are filing petitions for a rehearing.

It wasn't just the price changes that aroused the producers. In fact, many of the petitions concentrate their fire on two other conditions which they feel would have a serious, far-reaching impact on the industry:

... Weaker take-or-pay clauses which would permit Transwestern to take only 75% of the minimums called for in its contracts with the producers. Normally, a purchaser must take all of the minimum contracted for—or pay for it.

... Waiver of producer rights to increase rates, subject to refund. Under normal procedures, a producer or a pipeline firm can request a rate hike and, if the FPC does not act within 5 months, can put the higher rate into effect. It is subject to refund only if the FPC eventually turns down the request after holding hearings.

In the Transwestern case, FPC asked the producers to agree not to put a rate hike into effect until final FPC action on a request. Since it often takes years to settle a rate matter, the effect of the FPC request would be to freeze a producer's prices for that period.

Objections . . . The producers argue that the FPC has gone far out of bounds in seeking to change take-or-pay clauses and in asking for waivers of price-hike rights.

Here is the way attorneys for Gulf Oil Corp. sized up the FPC action on the take-or-pay clause:

"This condition would destroy one of last remaining elements of protection which producers have in contracts and have considered so vital for so many years."

Gulf defended the normal take-or-pay clause on these grounds:

It assures the producer that the purchaser will actually take the minimum called for. Otherwise, the purchaser would be free to acquire other supplies and just take from an individual producer what he wants to take.

It protects the producer from drainage and damage which might occur if his gas is not withdrawn at the same rate as that from adjoining leases.

By contrast, Gulf charged, the FPC approach is discriminatory because other producers in the same field may not be similarly restricted. Furthermore, by permitting the pipeline to take only 75% of the minimum this has the effect of extending the time of the contract from the original 20 years to 25 years, meaning that the producer's annual revenue would be reduced.

Gulf concluded that such FPC control of the rate of take constitutes an invasion of state regulatory authority.

Magnolia Petroleum Co. said the FPC condition "would render these certificates unacceptable to a prudent operator."

Hunt Oil Co. was even more blunt: "Our contract with Transwestern would not have been executed without the take-or-pay provision."

FPC view . . . In ordering Transwestern to include in its revised tariffs and rate schedules a modified minimum bill eliminating the high original minimum provisions, FPC presented this argument for changing the take-or-pay conditions:

The utility company would not be able to take at all times the minimums set in its contract with Transwestern. The effect, then, would be to make it pay for gas it wasn't getting.

"Rate payers ought not supply a constant flow of dollars to Transwestern for a variable supply of gas," the FPC said.

In other words, FPC hinted that high minimums were set as a means of "padding" the rates.

Other objections . . . The producers did not limit their challenges to the issue of take-or-pay or to the waiver request. They found other areas in which they felt the FPC had erred.

These included:

... Too much emphasis on price. Gulf said that all factors bearing on the public interest should be considered—not price alone. The company argued that the FPC apparently decided "public convenience" requires it to hold the price line on an area basis regardless of other factors.

The practical way to keep consumer prices low, Gulf said, would be to let the initial Transwestern rates stand so that producers would be encouraged to develop additional supplies which will soon be needed in California. Otherwise, it said, shortages will develop, forcing consumer prices upward.

"The present action of the commission can only operate to reduce supplies," Gulf said. "This is clearly not in the public interest."

... Unfair to certain areas. The FPC action, if upheld, would mean that producers in the West Texas-Permian basin and in the Panhandle-Hugoton areas "shall continue to be have-nots as far as prices are concerned," Gulf said.

A producer there can't hope for a price to enable him to explore the deep horizons of areas best suited to serve California, Gulf insisted. Instead, "the producer will have to divert his exploration dollars to other areas where market prices give some hope of a reasonable return."

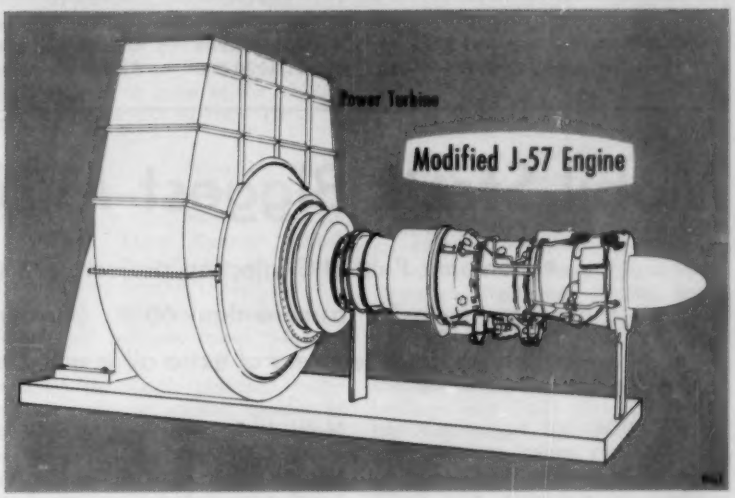
. . . Mistaken about prices. Several producers said the FPC made mistakes in determining the highest certificated price in some areas.

Sun Oil, for instance, said the FPC was wrong in saying that the highest price in the Panhandle-Hugoton area is 17 cents per M.c.f. The FPC mistake in using this as a yardstick in the Transwestern case, Sun said, was in failing to consider that the price FPC had cited would be more than 17 cents if B.t.u. adjustments were made to put the gas on a comparable basis with that to be supplied to Transwestern.

Sun also pointed out that by sticking to prices set several years ago, the FPC was failing to give any consideration to the effects of inflation on gas costs and prices.

Jet Engine Invades Gas-Turbine Field

- Gas-operated J-57 will power gas turbine. First use slated on natural-gas pipeline.



THE JET ENGINE is coming down to earth to be harnessed as a stationary gas engine.

Cooper-Bessemer Corp. and Pratt & Whitney Aircraft are joining hands to put a modified version of the well-known J-57 jet engine to work driving a specially designed gas turbine. The massive thrust of this engine, which powers the Boeing 707 and Douglas DC-8 jet planes, will thus be converted into commercially usable horsepower, according to E. L. Miller, C-B president, and Leonard C. Mallet, P&W general manager.

Using natural gas as a fuel, the jet-turbine combination will be a natural for gas transmission lines. And the first model is due for such service next year when a centrifugal compressor will be coupled to the jet-turbine combination for installation on a natural-gas pipeline. Basically, as an industrial gas turbine, the unit is applicable anywhere industrial power is required, such as refineries and petrochemical plants.

Conventional piston-type aircraft engines have been used as stationary power plants before. A fairly recent oil-country use, for instance, was Dowell's installation of aircraft engines on trucks to drive the heavy-duty pumps used in hydraulic fracturing operations. However, installations such as these involve simply a direct power takeoff from the revolving shaft of the engine.

New concept . . . The use of the jet engine involves a completely new concept, says R. L. Boyer, C-B vice president and director of engineering.

Naturally, no direct connection is possible. Rather the thrust of the hot, compressed gases being exhausted from the engine have to be converted into rotative horsepower. Cooper-Bessemer came up with a specially designed power turbine which utilizes the thrust and converts it into a rotary power output. The direct power takeoff can then be made from the power turbine shaft.

From a practical standpoint, conversion of the jet engine to operate with gas as a fuel was an essential feature. Pratt & Whitney solved this problem by modifying the basic J-57 engine. The company came up with a "package gas generator" which could be bolted to the power turbine. One of the important changes, of course, was to install a gas-injection system in the combustion chamber.

Industrial gas turbines are relative newcomers to the power field but have been used with increasing frequency in the past few years. They have found considerable acceptance on gas-transmission lines and are showing up more and more in gas-processing plants.

Cooper-Bessemer's entry into the picture is a bit different from its forerunners since it is not starting from scratch with a complete gas turbine unit. Boyer says this makes it possible to take advantage of the jet engine as a fully developed "gas generator."

Thousands of the jet engines have been built for commercial and military aircraft. Modifying it to operate on gas has been successful, and one has been in operation at Pratt & Whitney's Hartford, Conn., plant. An experimental prototype of the complete gas turbine is under construction at C-B's Mount Vernon, Ohio, plant.

Advantages cited . . . There are many advantages in using the J-57 from a cost, engineering, and operational standpoint, Boyer says.

No direct costs are being quoted at this early stage. But from experimental data, the horsepower costs of the newly developed power plant should be materially lower than those currently in use, and it will match the prevailing 25% efficiency ratings.

Costs are low because the unit is quite compact—no regenerator is required—and it's light weight, an inherent feature of aircraft engines. The 10,500-hp. compressor installation being built will be initially powered with a modified jet weighing only 4,000 lb.

One of the best features from an operational-maintenance standpoint is its interchangeability. At overhaul time, a replacement for the jet can be installed in about 4 hours, holding downtime to an absolute minimum. The replaced engine can then be leisurely overhauled in a shop.

The nature of the entire system lends itself to automation, and the first installation is being designed for unattended operation.

What Mobil Expects From Its Big North Pembina Unit

The Unit

Unit area, acres	46,000
Under LPG flood, acres	13,000
Under water flood, acres	33,000
Total oil in place, bbl.	740,000,000
Production to 8-1-59, bbl.	32,000,000
Remaining oil in place, bbl.	708,000,000
Estimated primary recovery, bbl.	118,000,000

LPG-Flood Area

Remaining oil in place, bbl.	253,000,000
Estimated recovery by LPG, bbl.	152,000,000

Water-Flood Area

Remaining oil in place, bbl.	455,000,000
Estimated recovery by water, bbl.	182,000,000
Total Estimated recovery, bbl.	366,000,000

Mobil Starts Biggest Miscible Flood

• Pembina field LPG-injection project covers 13,000 acres, will kick up recovery from 16 to more than 60%. Surrounding 33,000-acre water flood will boost total recovery of extra oil in unit to something like 250,000,000 bbl.

THE WORLD'S biggest miscible-phase recovery project got under way last week in Pembina field.

Mobil Oil of Canada, Ltd., began injecting a butane-propane mix into two wells to kick off a program which is expected to add 50 years to the primary productive life of this section of the giant Canadian oil field.

The Mobil recovery program actually involves 46,000 acres in its North Pembina Cardium unit. LPG, however, will be used only in the center portions of the unit. The remainder, 33,000 acres, will be water flooded.

Together, the two secondary-recovery methods are expected to jump recovery from an estimated 16% of oil in place under primary means to 49.5% or more. They will mean an ultimate production from this portion of the field of 366,000,000 bbl., compared with only 118,000,000 bbl. under primary methods.

And they will extend production life from an anticipated end in 1980 to perhaps 2030.

Long project . . . Mobil, operator of the unit for 14 other operators, expects to inject 3,000,000 bbl. of LPG into the Cardium over a 3-year period.

It will follow this huge LPG slug with gas injection over the next 60 years.

It is starting now with two LPG injection wells, but will convert three more to LPG injection next year.

There are 573 productive wells in the Mobil unit, 320 of them owned by Mobil. Wells are on 80-acre spacing.

LPG flood . . . The full-scale LPG-injection project follows successful completion of a one-well pilot project in the eastern section of the North Pembina unit.

The pilot was in operation from December 1957 to October 1958. It recovered 70% of the estimated oil in place and, Mobil says, gave "indication of even greater recovery possibilities."

It is basing its estimates of future production in the 13,000-acre miscible-phase flood, however, on a conservative 60% recovery figure.

Mobil estimates remaining oil in place under the 13,000-acre area at 253,000,000 bbl. It sets future recovery under LPG flooding at 152,000,000 bbl.

Water flood . . . Mobil is circling the LPG flood with a 33,000-acre water flood.

It will use an inverted nine-spot pattern requiring 91 injection wells.

Remaining oil in place under the water-flood area is estimated by Mobil at 455,000,000 bbl., with a future recovery estimate of 182,000,000 bbl.

The huge Mobil unit covers roughly one-seventh of the entire Pembina field, Canada's largest.

Pembina now covers roughly 300,000 acres and contains 2,900 wells.

The field was discovered in July, 1953, with Socony-Seaboard 1 Pembina. The second test, however, was a dry hole; and it was nearly 3 months before the operators got their second producer and a year before the usual boom hit the area.

First production in the field was found in the Cardium pay at 5,120 ft. Pembina is a stratigraphic trap with solution-gas drive.

Primary reserves have been estimated at about 1 billion barrels of oil.

Kimball Field Flood Set

A WATER FLOOD in the Kimball field, Nebraska, will be started soon after October 1 with Pan American Petroleum Corp. as operator.

There are 48 wells in the 8-year-old field, producing from the J sand at 6,520-40 ft. Production reached a peak of 3,430 bbl. daily in March 1957, and has declined to 875 bbl. daily. The flood is expected to increase recovery up to 60% of primary.

There are 700 royalty owners and 600 working interest owners in the unit. The field is in Kimball County, in the extreme southwest corner of Nebraska. Part of it lies under Kimball, where there was extensive town-lot drilling.

Other operators in the unit include Shell Oil Co., Bel-Air Oil Co., Champlin Oil & Refining Co., Great Western Oil Co., Natural Gas & Oil Co., Nebraska Drillers, Inc., Republic Natural Gas Co., Webb Oil Co., Basin Pipe & Supply Co., Bedrock Oil Co., Wayne McDaniel, Inc., W. E. Conway, and Earl Dean.

Dora Roberts Holdings Sold

. . . to Cities Service and General American in $13-million deal. Properties include 2,400 acres with eight wells.

CITIES SERVICE Oil Co. and General American Oil Co. of Texas have hiked their big Dora Roberts field holdings with a $13,000,000 purchase of properties from Lawrence E. and Docie Brown estate.

The two companies acquire full working interests and royalty rights to oil and gas under 30 tracts of 80 acres each in the prolific West Texas field in western Midland and eastern Ector counties.

The properties now have eight wells, with 14 completions, producing a daily average of 1,200 bbl. of oil plus substantial casinghead gas. The two buyers also acquire an interest in the Dora Roberts gasoline plant.

The buyers will pay about $2,900,000 in cash for the producing properties plus another $9,500,000 in oil from 90% of the production. They reportedly are paying another $660,000 for the interest in the Roberts plant.

The estate in turn conveyed the production payment to Olympic Investment Corp. of New York for a reported $9,900,000. Olympic has filed a deed of trust covering a $6,000,000 note given to the Chase Manhattan Bank of New York and a $3,000,000 note given to the Mutual Life Insurance Co. of New York.

Big gamble . . . Originally, Cities Service and Forest Oil Corp. gambled $5,000,000 in lease bonuses that the 19,200-acre Dora Roberts Ranch would pay off with big oil in the initial leasing deal in 1953.

For this, Cities Service and Forest bought oil and gas leases on one-half of each of the 30 sections of land on the ranch plus the entire mineral rights on another quarter of each section. Full mineral interest in the remaining fourth quarter of each of the 30 sections was retained by the Dora Roberts heirs, Mrs. Docia Brown of Fort Worth, and Mrs. Frank W. Waters of Houston.

The latter interest later was split up by the Brown-Waters interests so that each retained full mineral interests under an 80-acre tract in each section.

It is the 2,400 acres owned by Mrs. Brown which has now been purchased by Cities Service and General American. Mrs. Waters retains one-third of her original holdings in the field, hvaing sold the other two-thirds last year.

The Cities Service-Forest gamble began paying off in 1954 with the first oil strike on the ranch.

Production now has spread until wells produce from five established fields on the ranch—Dora Roberts, Headlee, Warsan, Virey, and Moose.

And 10 separate formations have proved commercially productive. They include the Ellenburger, Fusselman, Devonian, Wolfcamp, Strawn, Bend, Grayburg, San Andres, Queen, and Clear Fork.

Forest, one of the original partners, sold out its interest in the combined holdings with Cities Service to General American in April 1948 for $16,000,000.

Cities Service acts as operator of all producing properties on the ranch.

PROCESSING BRIEFS . . .

Octane numbers of both regular and premium gasolines have inched up to record highs. Ethyl Corp.'s August survey shows national weighted average of premium at 99.2 Research octane number, up 0.1 over July. Regular gasoline also gained 0.1 octane number to average 92.1. Motor octane numbers showed similar gains, with premium averaging 92.1 and regular, 84.3.

A 30,000-metric-ton ethylene plant has been put on stream in Ferrara, Italy, by Montecatini. Ethylene production will be of 95 to 99.8% purity. The plant also will produce 15,000 metric tons of high-purity propylene from pyrolysis of light or heavy naphtha. The plant was engineered by M. W. Kellogg Co., New York, and Kellogg International Corp., London.

A deasphalting plant has been put on stream by Lion Oil Division of Monsanto Chemical at its El Dorado, Ark., refinery. The 5,260-bbl. unit will use propane as solvents to convert low-grade fuel-oil feeds into salable asphalt grades. The plant is the second in the U. S. designed by Badger Manufacturing Co. to produce specification asphalt. The first is operated by Anderson-Prichard Oil Corp. at Arkansas City.

Midland Cooperatives, Inc., has let contract to Procon, Inc., for a 1,300-bbl. daily HF alkylation unit at its Cushing, Okla., refinery. Completion date has been set for April 1960.

Henry Bower Chemical Manufacturing Co., Philadelphia, will distribute its nitrosyl chloride in commercial quantities. The chemical has interesting potential uses with olefinic hydrocarbons. It also has been used in controlling the chlorination of hydrocarbons, in activating cracking and oxidation catalysts, and in increasing the cetane number of diesel fuel oils.

A CM-2 analog computer has been purchased by Dow Chemical Co.'s Texas division from Southwestern Industrial Electronics Co. Dow will use the computer for efficiency calculations on pilot-plant operations at its Freeport, Tex., petrochemical complex.

New polyethylene facilities—with a capacity of 80 million pounds annually—have been placed on stream by Union Carbide at its Whiting, Ind., plant. Union Carbide now has nine polyethylene plants in the U. S. with a total capacity of more than 400 million pounds per year.

Also for Refiners . . .

IN THE NEWS: Moves continue to negotiate settlement of remaining refinery strikes (p. 95) . . . Isolated crude-price cuts in California, Four Corners, Oklahoma, Kansas finding very little support (p. 102).

PLUS THESE TECHNICAL REPORTS: Annual petrochemical report and plant survey (p. 121) . . . Making high-quality asphalt with a propane deasphalting unit (p. 166).

Isolated Price Cuts Find Little Support

• Lower postings appear in California, Four Corners, the Oklahoma Panhandle, and Southwest Kansas. But they're not expected to spread.

CRUDE prices were under pressure in three isolated areas last week.

Union Oil Co. of California posted reduced prices in California and the Four Corners region. The California cuts ranged from 10 cents a barrel on 14°-gravity and heavier crudes and up to 50 cents on 27°-gravity and lighter crudes. The Four Corners cut was 30 cents a barrel.

Derby Refining Co. and National Cooperative Refinery Association of Wichita, Kans., also reduced prices in Southwestern Kansas and the Oklahoma Panhandle by 15 cents a barrel. This puts the top price at $2.70.

The explanations . . . In announcing the Union cuts, Board Chairman Reese H. Taylor said "the economic facts of life will no longer permit us to ignore the differentials" between foreign crudes and products and California crude and products.

The sloppy California gasoline market probably triggered the cuts. Southern California in particular has been the scene of a severe gasoline war for months. Major company housebrand and premium gasolines have sold for as little as 21.9 and 25.9 cents a gallon respectively in some stations. Usual prices are 30.9 cents for regular and 34.9 cents for premium.

Gasoline stocks on the coast at midyear were 2,444,000 bbl. greater than last year. Imports into District 5 for the first half averaged 201,000 bbl. daily compared with 167,000 bbl. daily for the same period last year. Part of this increase is due to shipments of Canadian crude which may be brought in without quotas.

Backed off . . . Union tried similar price cuts last March but had to rescind the orders later when no other company followed.

Union actually restored some prices to levels higher than they were at the time of the cut (OGJ, Apr. 6, p. 85).

Long Beach crude is a typical example of what has happened. Last March, Long Beach 40°-gravity crudes were cut to $3.07 a barrel. A month later, they were boosted back to $3.67 a barrel. The latest cut now puts the same crude down to $3.17 a barrel.

The sequence on Four Corners crude was this: From a price of $2.69 a barrel for 30-36.9° gravity, the March cut lowered the price to $2.12 a barrel. The price was put back to $2.82 a month later and last week was trimmed to $2.52 a barrel.

Protests . . . The Oil Producers Agency immediately protested Union's price cutting and moved to forestall similar cuts by other purchasers.

By midweek the only firm to match cuts made by Union was General Petroleum Corp. Its postings were substantially the same as those of Union.

A check revealed that other purchasers were studying the matter but planned no immediate moves.

Stark Fox, executive vice president of Oil Producers Agency, said the California cut followed reductions last year amounting to as much as 90 cents a barrel and came in the face of continuous mounting costs of domestic production.

He added: "Our information is that Union Oil attributes the necessity for this action to the plentiful supply of cheap imported oil and its products. Regardless of the merit of this contention, we are convinced that the principal purchasing companies in District 5 are certainly responsible for the maintenance of conditions in the industry that will preserve its ability to make the maximum quantity of domestic oil available at all times for reasons of national security.

"This cannot be done if continuous erosion of prices takes place. We therefore urge you as one of the companies who purchase the bulk of California production to hold the price line to the benefit not only of the domestic producer, but through him to the benefit of the nation itself."

Fox also fired off a wire to Capt.

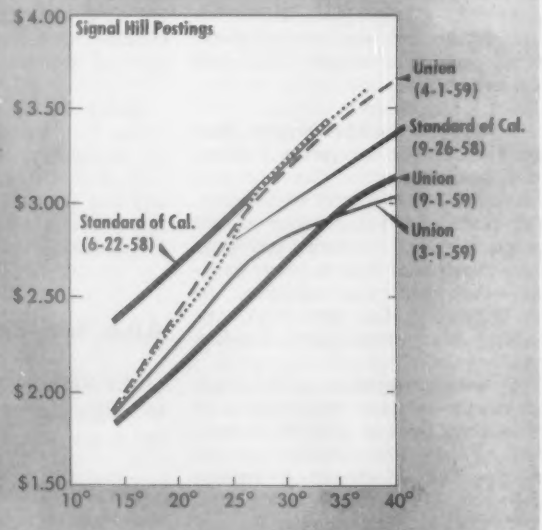
California's Bouncing Crude-Price Picture

Union Oil's crude-price cuts announced last week put California crude postings on a trend similar to the postings of June, 1958—but the postings are from 60 to 50 cents lower than the mid-1958 prices.

Heavy crudes have been hardest hit by the price gyrations in California in the past 15 months. They have been cut as much as 60 cents while the biggest cut for a higher-gravity crude has been 50 cents.

In the case of 14-14.9° -gravity crude, there is a 60-cent spread between the $1.76 posted by Union last week and the $2.36 posted by Standard of California in June, 1958. The spread drops to 53 cents for 26-26.9° crude and to 52 cents for 34-34.9° crude.

In the higher gravity crudes, Union's new postings actually are higher than those posted at one time during the 15 months. Union made an abortive cut in March that whacked 60 cents off the higher gravities. But this cut was restored the following month.



M. V. Carson, Jr., administrator of the oil imports program, vigorously protesting the new cuts.

Fox pinpointed imports in placing the blame for the slashes and urged that Carson "take whatever steps may be available to you to correct this condition."

A special problem . . . The Oklahoma Panhandle and Southwestern Kansas price cut is not expected to spread to other areas.

Derby and NCRA spokesmen explained the crude has a high-paraffin content and must move to refineries equipped to handle it. Recently, crude from other areas, including Canada, has taken some of this market. The lower price is necessary to meet the competition.

Actually the producers may not be hurt as much as it seems. At the time of the cut, the Jayhawk Pipeline Co. which moves the crude lowered its gathering charge 5 cents a barrel. Derby officials also said that the cut may create a larger market and allow production to be increased.

All quiet in East Texas . . . Meanwhile, the crude-price situation now appears to have stabilized in East Texas field.

No other major buyer has followed Atlantic Refining Co.'s lead in chopping 20 cents a barrel off the posted price there.

At the same time, Atlantic showed no signs of being ready to back off by raising its present $3.05 price to the general East Texas posting of $3.25.

The company, though a month and a half has passed since its price cut, is still under no economic pressure to rescind the cut. A company official told the Journal last week that Atlantic had lost only two connections during this period, and they totaled about 110 bbl. daily. This compares with total purchases in the field, including a small amount of contract oil bought for others, of around 5,000 bbl. a day.

Thus, Atlantic is realizing a 20-cent-a-barrel advantage over other purchasers on that oil it buys in East Texas.

Odds are that the situation will continue to rock along in the status quo unless the Texas crude situation should again get sloppy. And the latter event is unlikely. Currently, crude stocks—both nationally and those of Texas origin—are considered in very good shape. Actually, they are somewhat below the average indicated as desired for this time of year by the industry in testimony last spring before the Texas Railroad Commission.

Atlantic conceivably, however, could be forced back up if stocks were to tighten up much more. In such an event, the company might lose most of its East Texas oil purchases to other buyers.

Indications are that Texas independents have gone about as far as they are willing to go down the low-allowable road. Informed sources feel that the Texas crude allowable for October may be jumped to 11 days.

Feeling is that the market can absorb an increase from the current 9-day schedule without again creating a sloppy crude condition.

Why no takers? . . . Why is it, when so many companies felt a few months back that East Texas crude was overpriced, that no one has followed the Atlantic price cut?

There appear to be three principal reasons:

. . . Texas crude stocks suddenly tightened which made buyers less inclined to cut crude prices.

. . . Two large crude buyers, Humble and Gulf, though heavy producers in East Texas field, process very little oil from this field in their refineries. A high East Texas price therefore would appear to be to their advantage.

. . . The general uproar caused by Atlantic's cut scared off some others who process East Texas crude and favor a lower price.

INDUSTRY BRIEFS . . .

Stockholders of both Signal Oil & Gas Co. and Eastern States Petroleum & Chemical Corp. voted overwhelmingly to merge the two companies with Signal the surviving company. The basis of the merger was a stock exchange of one share of Signal Class A for five and one twenty-fifth shares of Eastern States. R. B. Kahle, chairman of Eastern States, and R. N. Blaize, president, will become vice presidents and directors of Signal. Included in the deal is Eastern States 60,000-bbl.-daily refinery and research center in Houston as well as an interest in the Rancho pipeline from West Texas to Houston.

Diversa, Inc., Dallas, has completed negotiations to take over management of all producing properties of National Drilling Co. National Drilling owns 57 net wells producing a net 700 bbl. of oil daily from fields in West and South Texas, New Mexico, Colorado, and Arkansas.

"Good faith" acquisitions of leases will soon be on safe legal grounds. The House and Senate have passed almost identical bills to protect persons who innocently acquired leases originally obtained by others in violation of acreage limitations. Technical differences in the two bills are being ironed out and the legislation should be ready to go to the White House.

Kerr-McGee lifted its purchaser proration in Oklahoma last week and will resume buying all its allowable. Proration was started July 1 when Kermac lost its resale markets for the excess crude.

Through agreement with Jonnell Gas Co., Crescent Petroleum Corp. has acquired an interest in approximately 50,000 acres of oil and gas leases in Zapata and Starr Counties, Texas. The acreage offsets the recently extended Lopena gas field. Crescent will complete four wells, offsetting gas wells, in the next 4 months.

A minimum allowable of 50 bbl. per day per well is provided in a proposed amendment to the Oklahoma constitution, which a newly organized group hopes to submit to a state-wide vote. Petitions seeking 175,000 signatures will be circulated by the Independent Producers and Royalty Owners Association of Oklahoma, which is headed by W. A. (Gus) Delaney, Jr., Ada independent.

Stanton Oil Co., San Antonio, has bought 70% interest in Turkey Track field, Eddy County, New Mexico. The leases contain more than 1,000 acres and were purchased from Robert E. McKee, General Contractor, Inc. Turkey Track is being water flooded in the nearby Caprock area, and Stanton will install a 6,700-acre water-flood project in the newly leased area.

A motion to dismiss the Government's subsidence damage suit against 125 small operators in the Wilmington field was filed in Los Angeles Federal Court last week. Not affected by the move were 269 other defendants in the suit. In asking for the dismissal, the government attorney said the 125 defendants were either too small to be involved in the suit or actually had nothing to do with the subsidence.

TYPICAL session in Great Western's training program for drilling crews. The company is convinced . . .

Drilling School Is Paying Dividends

• Three years of operation have tested Great Western's crew-training program. Proof of its success is company's plan to expand the school to include derrickmen as well as drillers and motormen.

Ed McGhee
Drilling Editor

THE UNIQUE "back-to-school" movement launched 3 years ago for Great Western Drilling Co. crew members is proving to be a good investment—for both the company and the employes.

The Midland, Tex., firm pioneered the formal school program in 1956 (OGJ, Oct. 8, 1956, p. 169). Promising men from the rig crews attend the 2 to 3-week sessions at company expense, receiving classroom instruction in how to better perform their jobs. When school is out, the men return to their jobs to apply what they have learned.

With 3 years of trail blazing now behind, the school has meant better-trained employes for the company and promotions and higher pay for most of the crew members.

Great Western officials point out another benefit: The school has been a morale booster.

Great Western not only is convinced the program should be continued, but plans are being made to expand the school to include derrickmen. Only motormen and drillers now attend the sessions.

Principal goals of the training program are to teach better preventive maintenance and to form a nucleous of qualified men to promote into supervisory jobs.

Success . . . Even the advanced cost-accounting methods used by Great Western do not make it possible to assess the dollars and cents return of the training program.

But it's easy to see and measure the success of one of the company's goals—better trained personnel.

Through May of this year, 76 motormen had graduated from the school. Of this number, 28 (37%) have already been promoted to driller. Another 32 (42%) are still working as motormen but are in line for a driller's job as soon as one is open.

Only 16 (21%) of the motormen have left the company in the 3-year period.

Twenty-six drillers have attended training classes. Of these, 19 are still working as drillers. Five, however, have been promoted to rig supervisor. Only two of the graduate drillers have left Great Western.

Great Western officials say that one of the greatest benefits of the training school is better morale. Men who have completed the course take pride in it; they know that they can advance in the company if they continue doing a good job. As a result, the men feel a loyalty to their company. Usually, in the drilling industry, a crew member feels loyalty only for his driller and a driller only for his rig supervisor.

Changes made . . . The methods and topics of the school have been revised and improved during its 3 years of operation. Many of the changes were made at the suggestion of the men attending the sessions.

Where the 1956 sessions of the motorman's school lasted 5 weeks, the 1959 version has been pared to 2 weeks. This was mainly a result of eliminating a 2-week stint the students did working with the company's maintenance mechanics, both in the shops and in the field. What the men learned in this time, Great Western has decided, could just as well be learned on the rig in the normal course of work.

Three years of "shakedown" have shown where the course should be tightened up enough to get the remaining 3 weeks instruction into 2 weeks.

What the Training School Covers

FIRST WEEK
(Drillers and Motormen)

Outline of Company Organization: Purposes of program and explanation of employe benefits.

Safety Practices

Fuels: Specifications for fuels and proper handling of fuels from storage to fuel pumps and regulators. Includes measurements and gaging of fuel deliveries.

Hydromatic System: Principle of operation, care and maintenance.

Functions of Engine Equipment: Theoretical operation, followed by disassembly of equipment.

Duties and Responsibilities: Preparing forms, their importance, and how they are used.

Practical Application of Engine Equipment: Running of engines, carburetor settings, etc.

Diesel and Gas Engines: Theoretical operation and practical demonstration.

Light Plants: Care and maintenance; electric wiring, electric motors, switches, meters; practice on diesel equipment.

Wire Lines, Drill Pipe, Drill Collars, Automatic Driller.

Auxiliary Equipment: Mud pumps, centrifugal pumps, rotary tables, swivels, crowns—and their uses.

Cooling System: Testing of water, explanation of water hardness and effects on radiator cooler; pressure caps, water filters, cutaway of filters, cutaway of radiator cores; diagram of back-pressure system against cooling fans; radiator covers; thermostats and thermostat bypasses; oil coolers; vapor-phase cooling.

Review and Test.

SECOND WEEK
(Drillers and Motormen)

Fluid Valves, Torque Converters, Fluid Couplings: Care and maintenance; trip to supply company to observe stripped down torque converters.

Lubrication: Basic lubrication to cover lubricating oils, greases, testing procedures, and oil coolers; use of ASTM testing devices to illustrate the properties of different lubricants.

Drilling and Production Practice: Includes film on drilling.

Electric Rig Operation.

Draw works and Compound: How to check for worn sprockets and chains; oil system; adjustment of mechanical clutches.

Air-Operated Equipment: Nomenclature and uses.

Bits and Coring.

Supervisory Practices.

Review and Test.

THIRD WEEK
(Drillers Only)

Drilling Fluids: Functions and properties.

Drilling Conditions Affecting the Mud.

Control of Drilling Fluid Properties.

Clays and Chemicals: Brand names.

Testing Equipment: Tests on viscosity, hydraulics and pressures, and surfactant fluids; film on rotary drilling fluids.

Effect of Mud Properties: Rate of penetration; rig equipment.

Types of Fluid Used in West Texas.

Running Tests on Mud Samples.

Contaminating Samples to Observe Changes in Properties, Treating Out Contaminants.

General: Calculations and review.

Review, Discussion, and Test.

Driller's school lasts 3 weeks. Its content is much like the motorman's school plus an additional week of mud training. Derrickman's school, when begun, likely will be 2 weeks, Great Western officials say.

An average student . . . To see how the program operates, follow an average motorman as he is selected for schooling, attends classes, and goes back on his rig.

Our motorman has been working for Great Western for more than 6 months. His work has been enough above average that he has attracted the attention of his driller and rig supervisor.

These men contact their district drilling superintendent and ask that the motorman be given an opportunity to attend the first school possible. There's a waiting list for the school and a session is held at intervals determined by the Great Western management.

In the next several weeks, the prospective student will receive a series of personal-evaluation tests from Great Western's personnel department. These tests are not dependent on education but on natural aptitude for learning and supervising others. Early applicants for the school got a mechanical-aptitude test, but this was abandoned when its results didn't correlate well enough with the performance of the men on the job.

Our motorman is fortunate: His tests show that he is the kind of man that any company would like to keep and advance and he will be admitted to the next school.

Later on, when rig activity permits and there are enough qualified students, our motorman is told to report to the company's office in Midland to start his schooling. The motorman receives travel expenses to and from the Midland office. While at the school, he will receive pay for a 48-hour week.

For 5½ days in each of the next 2 weeks, the motorman and his seven to nine classmates listen to lectures, see training films, and watch demonstrations on topics that concern their jobs particularly and drilling generally. Some of the teachers are Great Western employes. Others are from service, supply, and manufacturing firms.

Atmosphere in the classroom is informal and the men are encouraged to participate in discussions. However, the students are serious because they know they are expected to learn and will be tested to show if they have. The tests, given at the end of each week are made up by the instructors, and test grades become a part of the man's permanent record.

Back on the job . . . When he gets back to his old job, our motorman will be expected to apply the things he has learned in school.

He'll be watched by his driller, and rig supervisor to see if his job performance has improved. Also, his name will be placed on a "master rig personnel board" kept at the home office. This board shows only rig supervisors, drillers, and trained motormen. It is used by the drilling superintendent to watch and control the trained motormen's moves between rigs and their training at the draw works.

After our man has been back on the job for 45 days, his supervisors will prepare a report which rates him on his enthusiasm, personality, emotional balance, ability to accept correction and criticism, cooperation, physical condition, and safety habits. If the report is favorable, he will be given a pay raise and ranked as a Motorman C.

From this point on, the man's progress is up to him.

Merit rating plan . . . Great Western planned a merit-rating system as a part of its original program to upgrade its personnel.

The system was to operate roughly like that used by the armed forces. In the case of motormen, the man

who had completed training school and had rated satisfactorily would be eligible to take examinations to get a "B" rating and the pay raise that would go with it.

Eventually, he might get an "A" rating if he were really first rate.

The difficulty in applying this merit-rating system has been that promotions have come fast for the graduate motormen. Before they have worked sufficiently long as Motormen C, most have been promoted to driller.

Great Western has not abandoned the merit-rating plan. The pay-raise incentive of the plan is one of the weapons that the company is counting on in its struggle to stabilize rig jobs eventually.

Company officials feel that as the proportion of trained men rises higher and higher, job turnover will dip lower and lower. As this happens, the time an employee spends "in grade" will lengthen out.

Then, the company feels that each man can become highly expert at his job. He will merit a correspondingly higher pay check than his untrained fellow workers.

And, by doing a superior job, he will return to the company the money it spent in training him.

Closer Tab Kept

. . . on imports of residual to prevent price gouging.

THE OIL IMPORTS Administration has begun making public a monthly breakdown of residual fuel oil imports, apparently in a move to guard against "unnecessary" price hikes.

The monthly report shows the company-by-company allocations for the July-December period, the amount each company has imported, and the balance each has remaining under its total 6-month allocation.

Thus, a company presumably could be put in a bad light if it hiked its residual fuel prices when it had not been importing all of its quota.

The first report, covering July, shows that 7,865,630 bbl. of residual were imported. This is 11.7% of the 6-month total allocation, and leaves 59,007,630 bbl. for the remaining 5 months.

The July imports fall short of being a sixth of the total figure, but seasonal factors and the fact that imports generally are slow during the first month of a new period may account for this.

Generally, companies with the highest allocations imported a higher percentage of their quotas in July than did the smaller importers. For example, Standard Oil Co. (N. J.), with a total allocation of 20,330,896 bbl., imported 3,024,918 bbl. in July. Paragon Oil Co. (now owned by Texaco, Inc.) imported 1,284,516 bbl. of its 6-month quota of 10,617,720. Hess, Inc., with an allocation of 7,594,600 bbl., imported 936,665 bbl. in July.

Imports Plan Hit

. . . by NYU professor. He says mandatory program hurts at home, abroad.

A COLLEGE economics professor, writing a treatise on the Government's mandatory oil imports controls, concludes that the program does this nation more harm than good.

The professor is William H. Peterson, of New York University. His study was published by the American Enterprise Association of Washington.

The association identifies itself as a nonpartisan research organization which studies national policy problems. Its work is directed by an advisory board made up of college professors. Its money is provided by U. S. business firms which "sponsor" the association.

Same old story . . . Peterson's 69-page essay, entitled "The Question of Governmental Oil Import Restrictions," offers very little new ammunition for opponents of the controls program.

Basically, Peterson argues that the controls plan:

. . . **Hurts the foreign** relations of the U. S.

. . . **Weakens** our defense position.

. . . **Depletes** domestic oil reserves.

. . . **Saps the oil** industry's vitality both at home and abroad.

Peterson says, too, that it provides an upward thrust to consumer prices and thereby adds to inflation.

He finds it odd that at the very time the U. S. is seeking to strengthen national defense by limiting imports, it is seeking to encourage more U. S. oil investments abroad—to strengthen the nation's defense.

He argues further that the restriction of the flow of foreign oil to American markets jeopardizes the free access of American citizens to oil concessions abroad, invites retaliation against American exports, injures American overseas investments, and penalizes the American consumer with higher prices for oil products.

He concludes that the "bureaucratic determination of the proper level of imports and of a nonexcessive price is virtually impossible and certain to be fraught with political pressures."

LACT Approved

. . . for use on Richfield's island off California.

AUTOMATIC custody transfer has made its debut in California's tidelands.

Richfield Oil Corp. early this month started using the method at its earth-filled island ½ mile off Rincon.

The State Lands Commission late last month approved use of LACT after the system had been tested for some 5 months. During this period about 68,000 bbl. of oil was shipped. The amount metered was 111 bbl. (0.16%) different from that manually measured.

Richfield now has slanted almost 20 wells from the 1-acre island into the 1,175-acre state granted lease. Ultimately 68 wells may be drilled. General Petroleum Corp. is buying the crude.

The waxy nature of the 30° gravity crude requires it be shipped warm; a temperature of about 140° F. is maintained on the 1,000-bbl. shipping tank. Also because the crude is waxy, meter proving is carried out on a gravimetric basis rather than volumetrically.

New Arbuckle Field Opened

CONTINENTAL OIL CO. has opened a new Arbuckle oil field in the South Sterling area of Comanche County, Oklahoma.

Conoco reported the James W. Mansel No. 1 flowed at the rate of 203 bbl. daily on a 36/64-in. choke at an interval of 8,685-9,190 ft. in the Arbuckle lime formation. The oil is 36° gravity. GOR is 5,850 to 1, and shut-in pressure is 4,000 psi.

The company said there are production possibilities also in the Upper Arbuckle at 8,060 ft. and in the Bromide formation at 7,150 ft.

The discovery well is on a 1,440-acre drilling unit about 9 miles northeast of Lawton. Conoco is the unit operator and 81% owner. Gulf Oil Corp. owns 14% and Atlantic Refining Co., 5%. Conoco holds 3,375 net acres surrounding the unit.

The nearest Arbuckle lime production is 65 miles east in the Southeast Hoover field.

INCREASES PRODUCTION by eliminating tubing breathing and buckling, thus lengthening the effective pump stroke and raising volumetric efficiency. While it is often difficult to determine exactly how great such increases are, many operators have told us that they have experienced as much as 50% gain.

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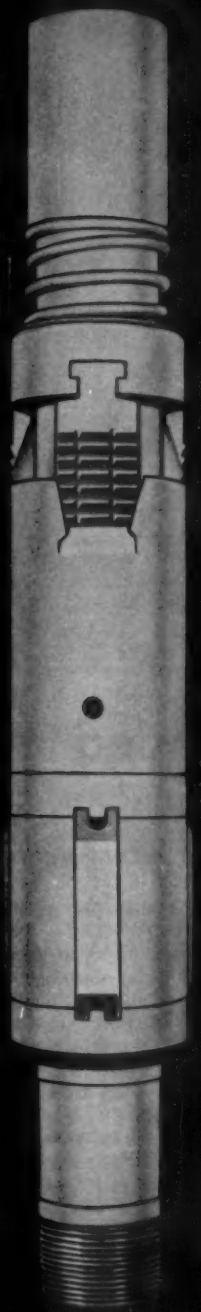

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Edwards Trend Is Extended

. . . 40 miles to the northeast by a Humble find. It's the first major discovery along the trend in recent years.

A NEW oil discovery in northeastern Bastrop County extends South Texas' Edwards lime trend of fields nearly 40 miles northeastward.

It is the first major stepout Edwards discovery in several years along the trend, which has produced such old prolific fields as Luling, Salt Flat, and Darst Creek.

The new well, Humble Oil & Refining Co.'s 1 Jones, is 2 miles west of Paige and not far from the Lee County line.

The well is rated good for 170 bbl. of oil daily from pay at 6,968-7,012 ft. Production is by pumping and agitation. Gravity of the oil is 24°. The well had been drilled to 9,816 ft., penetrating the potentially productive Lower Cretaceous Rodessa and Sligo sections.

The discovery climaxes scattered deep exploratory drilling along the trend, both in existing shallower-pay field and at wildcat locations, extending over many years.

Southwestward and coastward through the lower southwestern counties, Edwards lime has received an extensive exploratory play in recent years, resulting in a succession of important discoveries.

Closest field currently producing from the Edwards at the northeastern end is Branyon, in Caldwell County, adjoining Bastrop County on the southwest. There, Edwards pay was opened early in 1955 after the field had produced since 1928 from the shallower Austin Chalk.

Northeastward along the trend, at Tanglewood, in northeastern Lee County, 25 miles northeast of Humble's discovery, and at Chriesman, farther northeast in Burleson County, Edwards lime has produced in three small wells. These, two drilled at Tanglewood in 1948, and one at Chriesman in 1938, produced only short periods with only small recovery. They long since have been abandoned.

Humble's discovery is only 4½ miles southwest of another significant 9,800-ft. Lower Cretaceous wildcat drilled jointly in 1955 by Sunray Mid-Continent Oil Co. and Skelly Oil Co. Skelly, penetrating the deep Sligo zone, encountered promising oil and gas showings in the lower formations. But, it failed to make a well there and was plugged back to an Upper Cretaceous-Navarro sand at 4,500 ft. where it was completed as the discovery well of Addison field. The field is now abandoned.

The Edwards trend roughly follows the Balcones and Luling-Mexia-Talco fault zones, major geological features extending through southwest, south and east Texas.

Alaskan Deal Made

. . . giving Pan Am drilling rights in Bethel basin.

PAN AMERICAN Petroleum Corp. has been granted a 5-year development contract covering 465,280 acres in the Napatuk Creek area near Alaska's west coast.

The area is 12 miles west of Bethel, 450 miles west of Anchorage, and 420 miles from the Swanson River oil production in the Kenai peninsula.

Bristol Bay Oil Co., Sunray Mid-Continent Oil Co., and Empire State Oil Co., holders of acreage within the area, have joined Pan American in an operating agreement for the development work.

The contract granted by the Interior Department provides for minimum expenditures of $950,000 on exploratory work and the drilling of three exploratory wells, the first of which must be started by March 1, 1961.

After the second well is started, Pan American will be required to release half of the total area. The released acreage apparently would fall under mineral leasing acreage limits.

Seven wells drilled . . . The contract with Pan American is the sixth in Alaska, including four approved earlier this year. About 3,589,475 acres are in the six areas, with 12 companies involved.

The Interior Department thinks the use of these contracts spurs development more than simple acreage leasing. Apparently that is why the department opposed recent legislation (vetoed by the President) which would have increased oil and gas acreage limitations in Alaska to 600,000 acres. The present limit is 100,000 acres under lease and 200,000 acres under option by an individual or firm.

Gubik area . . . Interior also announced last week it is opening about 9,000 acres for leasing in the Gubik gas area of northern Alaska.

The tracts lie within the 2-mile buffer zone around Naval Petroleum Reserve No. 4. This area is adjacent to land leased by several companies earlier this year.

Borden Report Urges Delay

. . . in governmental action affecting Canadian oil to give companies chance to develop markets at home and in U.S.

THE FINAL report of Canada's Borden Commission recommends putting off any critical decisions affecting the Canadian oil industry for 12 to 18 months.

Leaving many questions unanswered, the 70,000-word document favors the 1 to 1½-year period to give oil companies the chance to double sales of Canadian oil in the United States.

Unless Canadian crude markets are expanded both in Canada and the U. S., the report proposes an embargo on imported crude oil in the form of a licensing setup.

The commission made no specific recommendation on construction of a pipeline from Western Canada to Montreal, other than to advise the Canadian Government against taking action on it at this time.

However, in discussing the controversial 2,000-mile pipeline—with an estimated price tag of about $370,000,000—the commission leaned toward its eventual construction as a government-owned project, backing the principle of "Canadian oil for Canadians."

The report was submitted to the Canadian Government, which must decide whether or not to set up a national energy policy based on the commission's findings and recommendations.

Market search . . . In suggesting the industry step up its efforts to sell Canadian oil in the U. S., the commission said the goal should be to raise production in Western Canadian fields to 700,000 bbl. daily by the end of 1960.

The report suggests that failure of the industry to expand Canada's markets could be met with:

. . . A possible embargo on oil from Venezuela and the Middle East, principal sources now for the Montreal market which imported 85,500,000 bbl. of oil last year.

. . . Building of the Edmonton-Montreal crude line to carry western Canada's oil into the Quebec market.

The report states foreign oil should continue to enter the Montreal market provided an outlet for an equivalent amount of Canadian oil can be found in the U. S.

It adds that the commission believes the oil companies with refineries in Montreal have sufficient connections in the U. S. to assure an expansion of Canada's market there.

In addition, the report calls on the oil companies to stop marketing foreign oil products in Ontario. It states the companies have been marketing about 50,000 bbl. of such products daily in Ontario—a market which should be served entirely by Canadian products.

Refineries in the Montreal area have a combined capacity of 263,500 bbl. daily. Refineries in Ontario have a total capacity of 227,530 bbl. daily.

The report recommends:

. . . Export of Canadian crude oil without license be "encouraged and permitted."

. . . That Canadian crude be used by any refinery in Canada with pipeline facilities to receive it.

. . . Any oil embargo to open up the Montreal market to Canadian oil should not include oil produced in the U. S. However, no U. S. oil is imported to Canada.

PIPELINE BRIEFS . . .

A major expansion of Iraq Petroleum's Kirkuk-Mediterranean crude system will be made by laying 250 miles of 30 and 32-in. loops on the line to Tripoli, Lebanon. Contract for the looping, as well as 65 miles of 30-in. connecting Rumaila field and the port of Fao to expand facilities from southern Iraq fields, has been let to Turriff-Burden, Ltd. Construction will be completed in 2 years. Turriff-Burden is owned by Turriff Construction Co. of England and Burden International of Canada. The latter firm is owned by O. R. Burden Construction Corp., Tulsa, and J. E. Burden, Casper, Wyo.

A 36-mile 20-in. gas line is being laid by Lone Star Gas which will loop its system in the Dallas area. It will permit increased deliveries of 50,000 M.c.f. daily. Gas will come from Lone Star's Tri-Cities storage field.

Some 50,000 M.c.f. of natural gas daily will be delivered to Shell Oil's Houston refinery and chemical plant from its own facilities at the Sheridan field and plant, starting February 1, 1960. This amounts to half of Shell's fuel-gas requirements which are now purchased from United Gas Pipe Line and Houston Pipe Line.

A 60-mile 8-in. line is proposed by Ohio Oil Co. to connect Scipio field, Hillsdale County, Michigan, with Buckeye Pipe Line Co.'s terminal south of Toledo, Ohio. A 20-mile spur also is planned to link Pulaski and Albion fields. Hearing on the permit application was scheduled last week before the Michigan Public Service Commission. Crude production in the area is about 5,000 bbl. daily, now hauled by truck.

A 49-mile 20-in. gas line is planned by Shamrock Oil & Gas from Dumas to Amarillo, Tex. Contracts have not been let, but construction is scheduled to be completed early in 1960.

Additional contracts have been let by Northern Natural for its recently approved expansion. R. H. Fulton & Co. will lay 55 miles of 16-in. from North Branch to St. Cloud, Minn., and Williams Brothers Co. will lay 57 miles of 10 and 12-in. from Brainerd to St. Cloud. The projects are scheduled to start this week.

Also for Pipeliners . . .

IN THE NEWS: Gas producers are balking at price conditions set up by FPC in Transwestern line approval (p. 98) . . . Jet engine used on airliners is converted successfully to a stationary gas engine (p. 99).

A complete list of pipeline projects is carried in the last issue of each month. Current projects are carried in Pipeline Briefs.

PLUS THESE TECHNICAL REPORTS: Motor and gas-turbine drive centrifugal compressor stations (p. 177) . . . Flash-point detectors for quality control of pipeline products (p. 205).

Gulf Coast Well Breaks High-Pressure Record

UNION OIL & GAS Corp. of Louisiana again has acquired the title of owner of the world's highest-pressure well. This time the company claims a seam-straining 12,800 psi. shut-in wellhead pressure.

The well is Union of Louisiana's 1 Flavie Vincent et al. in the Leleux area of Vermilion Parish, Louisiana. The nearest production is 1 mile away and in different pay zones.

Union of Louisiana's 2 Elue Roach in the Lake Arthur field held the pressure record (at 11,600 psi.) from January of 1957 until April of this year. In April, Tidewater Oil Co. completed its 2 Lacassane at 11,690 psi. (OGJ, Apr. 20, p. 66, and Feb. 11, 1957, p. 66). All the wells are in South Louisiana.

The 1 Vincent is completed through perforations at 16,912-28 ft. and flowed gas and distillate for several hours. No measure was made of production.

Total depth of the record well is 17,216 ft. Deepest pipe is a string of 2⅞-in. P-105 tubing, cemented through the pay zone after a 5-in. liner stuck while being run. Bottom of the 5-in. is 16,442 ft.

A 7-in. string is set at 14,964 ft. As it has in other high-pressure wells at Branch and Lake Arthur fields, Union of Louisiana hung a siphon string of 1¼-in. pipe.

Other than sticking the liner, the company reported little trouble in drilling and completing the hole. Mud weights of 18.5 lb. and 18.6 lb. per gallon were sufficient to keep the well under control.

The tree has a working pressure of 15,000 psi. and is fitted with high-pressure Grayloc connections.

Power Savings Made by Electric Variable-Speed Drives

THE FIRST electric variable-speed drives installed on a pipeline are resulting in the power savings for which they were designed.

Cherokee Pipe Line Co. installed single electric-driven pump units on each of the two 10-in. lines at the five booster stations between Glenn Pool, Okla., and Wood River, Ill. On each unit an eddy-current drive transmits the rotation from the constant-speed electric motor to the centrifugal pump.

This variable-speed drive provides a method of control of the unit and will adjust pump output to throughput demand without throttling, the accepted method of controlling pump output which results in power losses.

Experience gained in the first year's operation has shown:

. . . **Payout of 3½ years** for additional investment cost over throttling valves is indicated by power savings.

. . . **More complete range** of operations and increased capacities for given power settings have been realized through electric-demand controllers used in conjunction with the drives.

. . . **Smoother line operating** conditions reduce maintenance of pump and motor equipment.

Benefits from the new drives were reported to the American Institute of Electrical Engineers by E. C. Michels, chief engineer of Continental Pipe Line Co., which operates the Cherokee products system.

Taking one 600-hp. unit as an example, with a 75% load, or 22,500 bbl. of fuel oil daily, 525 hp. would be required with a throttling valve. Pump efficiency would be 71%. With the variable-speed drive, the pump would have an efficiency of 77.5% and a motor load of only 405 hp., or 120 hp. less.

At 1 cent per kw-hr., a power reduction of 120 hp. would amount to a savings of $7,820 per year for one unit, Michels reported.

World Production Shows Slight Gain

• After dropping for three straight months, output is picking up. Venezuelan increase provides push.

FREE-WORLD crude production rose slightly in June, but output did not climb back to the record levels reached earlier in the year.

The increase was due largely to a gain of 253,000 bbl. daily in Venezuela, and about 54,000 bbl. daily in Canada. U. S. output slipped 137,000 bbl. daily. The Middle East as a whole was down 153,700 bbl. daily, with Kuwait bearing the brunt of the loss.

West German operations produced more than 100,000 bbl. daily for the first time. Output came from 92 fields in six different regions.

Russia said it produced 61.7 million tons of crude the first 6 months, or about 2,490,000 bbl. daily. This level met the production quota. The gain of 14% over the first half of 1958 compared with a 17% increase in the same period last year. Gains in natural-gas production and oil-equipment manufacturing lagged behind the Russian plan.

TREND OVER THE LAST YEAR

	Western Hemisphere, less U. S.	Middle East	Total free-world outside U. S.
1958			
June	3,669.2	4,106.6	8,578.7
July	3,777.0	4,247.2	8,832.6
August	3,828.4	4,334.0	8,971.5
September	3,769.8	4,535.2	9,120.8
October	3,891.3	4,482.3	9,177.5
November	4,037.8	4,472.1	9,309.5
December	4,119.9	4,446.2	9,371.4
1959			
January	4,311.6	4,369.3	9,449.5
February	4,453.9	4,426.1	9,649.7
March	4,220.6	4,634.2	9,680.7
April	3,910.4	4,646.4	9,396.5
May	3,769.6	4,571.4	9,177.0
June	4,083.7	4,417.7	9,348.0

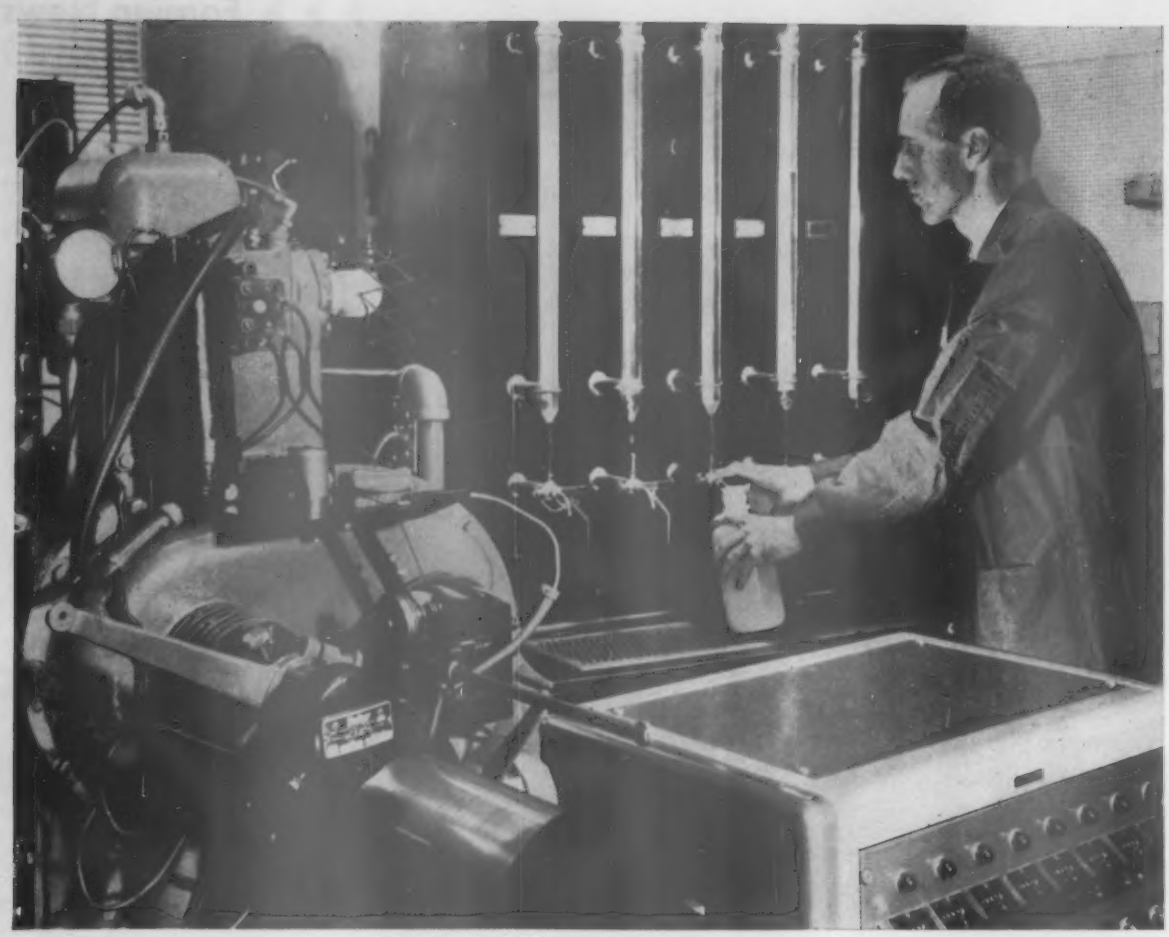
World-Wide Crude Production: Daily Average in Thousands of Barrels

Country—	June 1959	May 1959	June 1958
Western Hemisphere			
Argentina	115.0	115.0	93.1
Bolivia	8.9	8.9	9.3
Brazil	53.1	53.1	52.2
Canada	490.0	436.0	415.1
Chile	17.1	17.1	15.7
Colombia	143.3	137.3	124.2
Cuba	0.5	0.5	1.0
Ecuador	7.7	7.7	8.6
Mexico	268.1	268.1	257.8
Peru	48.6	47.8	47.2
Trinidad	109.1	109.1	99.2
Venezuela	2,822.3	2,569.0	2,545.8
Total	4,083.7	3,769.6	3,669.2
Europe			
Austria	45.5	45.7	53.3
France	31.8	30.5	27.2
West Germany	100.7	99.8	87.9
Italy	31.0	31.0	31.0
Netherlands	33.6	33.6	29.2
United Kingdom	1.7	1.7	1.6
Yugoslavia	11.8	11.8	9.2
Total	256.1	254.1	239.4
Middle East			
Iran*	949.0	983.0	794.0
Iraq†	823.3	803.7	755.4
Israel	2.0	2.0	1.3
Kuwait	1,268.1	1,440.2	1,383.2
Neutral Zone	115.0	115.0	53.7
Qatar	169.0	169.0	161.0
Saudi Arabia	1,084.8	1,052.0	951.3
Turkey	6.5	6.5	6.7
Total	4,417.7	4,571.4	4,106.6

Country—	June 1959	May 1959	June 1958
Other Asia			
British Borneo	107.0	107.0	104.5
Burma	10.5	10.5	9.6
India	8.5	8.5	8.5
Indonesia	345.0	340.0	330.3
Japan	6.7	6.7	7.3
New Guinea	4.4	4.4	3.7
Pakistan	5.9	5.9	6.2
Total	488.0	483.0	470.1
Africa			
Algeria	17.9	16.2	10.7
Angola	0.8	0.8	0.8
Egypt	58.4	56.9	64.7
Gabon	14.6	14.2	9.1
Morocco	1.8	1.8	1.5
Nigeria	9.0	9.0	6.6
Total	102.5	98.9	93.4
Free World			
Foreign	9,348.0	9,177.0	8,578.7
United States	7,083.0	7,220.0	6,341.0
Total	16,431.0	16,397.0	14,919.7
Communist Countries in Soviet Orbit			
Romania	235.0	235.0	227.0
Russia	2,490.0	2,490.0	2,230.0
Others	60.0	60.0	60.0
Total	2,785.0	2,785.0	2,517.0
WORLD TOTAL	**19,216.0**	**19,182.0**	**17,436.7**

*Includes estimated 5,000-bbl. daily from Naft-i-Shah field not operated by consortium companies. †Includes estimated 3,300-bbl. daily from Naft Khaneh field, operated by Iraq Government.

Figures are obtained from reliable industry reports or government sources. Estimates are made where complete reports are lacking



The time at which a flame occurs in the combustion chamber is recorded by Ethyl—developed instrumentation. This equipment is used to study surface ignition.

Ethyl Research studies nature and control of surface ignition

ENGINE NOISE and other problems stemming from surface ignition have been obstacles to the development of more efficient engines.

In the search for ways to solve the surface-ignition problem, Ethyl Research has pioneered in the development of instruments and techniques used to study the factors causing surface ignition and to search for ways of combatting the difficulty.

Several phosphorus additives which control surface ignition have resulted from Ethyl's work in this field.

What is Surface Ignition?

It is ignition of the fuel-air charge by any source other than the normal spark; in most cases, by glowing combustion-chamber deposits. It may occur before the spark plug ignites the charge (preignition) or after normal ignition (postignition). And it may produce a single flame or many flames.

"Rumble"—The Latest Problem

A more recent problem arising from surface ignition in the modern high compression engine is "rumble"—a low frequency noise produced when surface ignition causes very rapid rates of pressure rise and high peak pressures in an engine's cylinders.

Cars with high compression engines that contain deposits from light-duty operation are subject to "rumble" during full-throttle accelerations. The noise, generally heard at speeds above 2,000 rpm, can be very objectionable to the motorist.

Factors Affecting Surface Ignition

The presence of surface ignition in an engine reflects a combination of factors. Engine design, particularly compression ratio, has an important effect on this abnormal combustion. Operating conditions also influence surface ignition. The type of deposits that cause difficulty are likely to build up most rapidly during city driving. The character of the deposits is perhaps the most important factor.

Ethyl Research has shown that de-

posits causing surface ignition are affected by composition of fuels and lubricants. Volatile oils, such as the multigraded ones, generally produce fewer deposits, and thus less surface ignition, than do oils containing heavy ends.

In fuels, the worst offenders are high-boiling hydrocarbons, particularly heavy aromatics. Heavy aromatics not only produce more deposits, but these deposits are of a type more prone to ignite the fuel-air charge.

During the past few years, the refining trend has been toward more severe catalytic reforming and the use of deeper cuts of reformate for blending high-octane motor fuels. These practices increase the percentage of aromatic hydrocarbons, thereby accentuating the surface ignition problem.

Additives to Control Surface Ignition

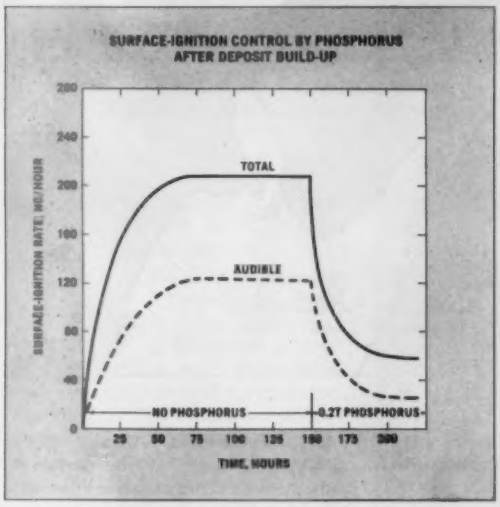
It has been known for several years that phosphorus additives are highly effective in reducing the tendencies of combustion-chamber deposits to ignite the fuel-air mixture.

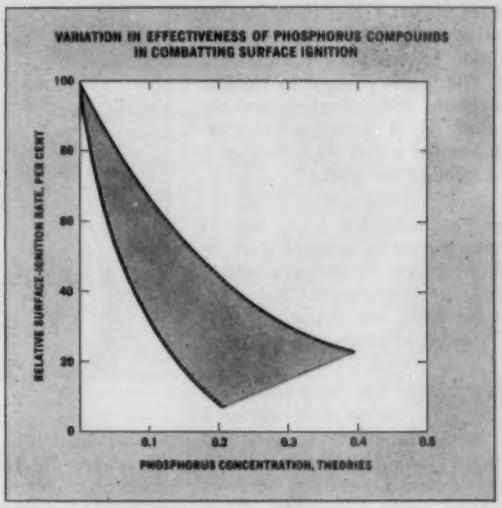
Extensive research has verified the effectiveness of phosphorus in reducing both the frequency and severity of surface ignition. Phosphorus is also effective in controlling surface ignition where deposits have accumulated before the use of the additive.

Ethyl Research has shown that different phosphorus compounds display varying degrees of effectiveness. Know-how in additive research has been applied to the screening of phosphorus additives for practical commercial use.

These screening tests include stability, solubility, inductibility, ability to combat spark-plug fouling, and possible adverse effects on engine wear, engine cleanliness, and valve life.

Phosphorus additives are widely used today. The need for them will grow as the percentage of high-compression cars increases and if the aromatic content of gasoline increases.




VARIATION IN EFFECTIVENESS OF PHOSPHORUS COMPOUNDS
IN COMBATTING SURFACE IGNITION
RELATIVE SURFACE-IGNITION RATE, PER CENT
PHOSPHORUS CONCENTRATION, THEORIES

How Ethyl Research can help you

ETHYL RESEARCH studies of surface ignition and its control are available to you through your Ethyl Representative. He will be glad to supply you with copies of our several publications on this subject, and to show the Ethyl film on "Rumble" to your technical people.

Ethyl now has three phosphorus additives that can protect your customers against surface-ignition problems. Two of these compounds are free of patent complications.

Each has its own special advantage and should be selected for your particular motor fuel requirements. These additives are backed by technical service, and extensive evaluation data on their performance are available from your Ethyl Automotive Engineer.

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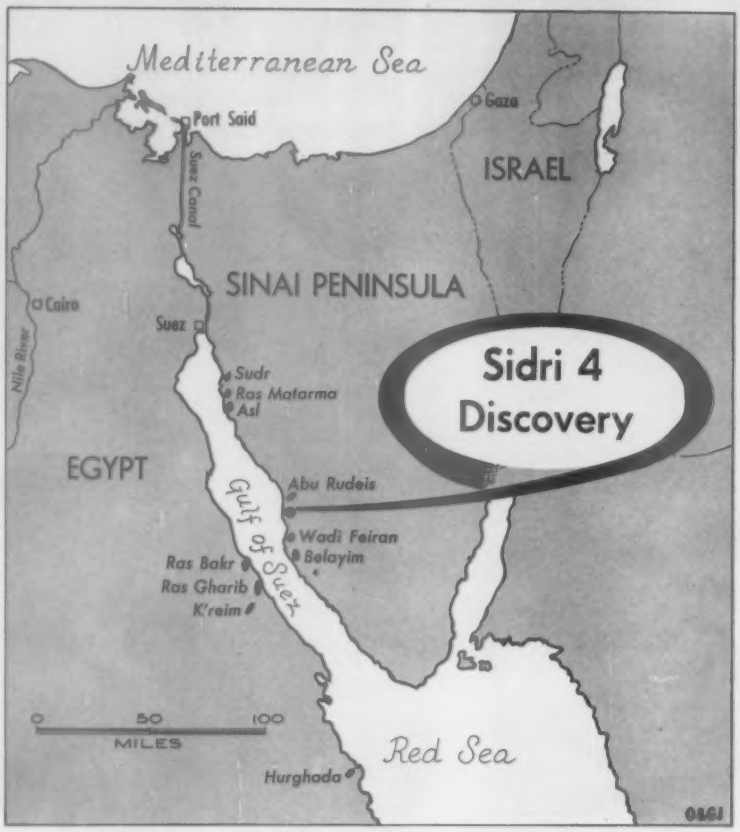
Another Find Bolsters Egypt's Hopes

• Details lacking, but Sinai well could top all previous discoveries.

EGYPT has long dreamed of becoming an important Middle East oil country, and a discovery on Sinai may help the wish come true.

Sidri 4, drilled near the Gulf of Suez, has come in as a 5,000-bbl.-daily well. No details of the discovery have been revealed, but Egyptians say the find may be the biggest ever made in the country.

The discovery is a feather in the cap of the Nasser Government, which has authorized a variety of types of exploration set-ups since coming into power. The country hopes to become a net exporter within 3 years, and the Sidri find by a joint government-foreign venture could go a long way toward meeting the goal.



Eastern Petroleum Co. . . . Sidri is the latest success of Eastern Petroleum Co., held 49% by the government, and 51% by International Egyptian, owned by ENI and Petrofina. ENI is the Italian government's oil company.

This company has developed three fields in Sinai in an area where a Jersey Standard subsidiary gave up exploration 10 years ago because it regarded the legal situation unfavorable. The fields, Belayim, Wadi Feiran, and Abu Rudeis, produce about 33,000 bbl. daily, or more than half of Egypt's 58,400 bbl. daily production.

Belayim has become the most important field in Egypt, yielding 24,000 bbl. daily from 34 wells. Pay is from three zones of Miocene. The first horizon, tapped at about 5,000 ft., has 24 to 32 ft. of net pay. A zone at 7,400 ft. has 50 to 200 ft. of net sand, and a zone entered from 8,150 to 8,600 ft. has 150 to 200 ft. of net sand. Traces were found in another zone, topped at 7,900 to 8,000 ft., but there is no porosity in most wells.

Abu Rudeis produces about 8,700 bbl. daily from five wells. The productive limits have not been found in either Belayim or Abu Rudeis, and indications are that both are major fields. Wadi Feiran is the smallest of the group, producing only a few barrels daily from four wells.

Sidri 4 has been classified as a discovery because the first two tests produced water only. Sidri 3 is an oil producer, but strictly speaking, it is part of the adjoining Abu Rudeis.

Government work . . . The government-owned General Petroleum Co. is also exploring on its own account on the Egyptian mainland.

Two fields with commercial possibilities, Ras Bakr and K'reim, were discovered last year along the Gulf of Suez. The first K'reim development well was completed at 450 bbl. daily. The new finds were on licenses that had long been sought by private companies.

Ras Bakr may be one of Egypt's best fields. General Petroleum has completed Ras Bakr 13 as the field's eighth producing well. It says the 3,520-ft. development well encountered four oil zones. The best horizon, an 84-ft. section between 2,824-2,908 ft., yielded oil at the rate of 310 tons, or about 2,200 bbl., daily on a 3½-in. choke. The rig is now being moved to the No. 14 location.

Dr. Muhammad Ahmad Salim, managing director of the company, said that field installations at Ras Bakr and K'reim are being put in as fast as possible to enable commercial production to start in December or January.

The fields are expected to produce 20,000 bbl. daily.

General Petroleum also plans to continue work on a vast area in the Western Desert that was given up last year by Sahara Petroleum Co., operator on nearly 58 million acres for Continental, Ohio, Richfield, and Cities Service.

The Sahara group drilled nine deep dusters over 4½ years in a program that cost $35 million. General Petroleum expects to concentrate its work in the vicinity of Mirsa Matruh, near the Mediterranean Coast, where a 14,998-ft. wildcat was sunk.

Old-line companies . . . A declining share of local production is from fields held jointly by Anglo-Egyptian Oil Co. (Royal Dutch-Shell and British Petroleum) and Mobil, and by

Mobil alone. Current output has slipped from 47,000 bbl. daily 6 years ago to 25,400 bbl. daily.

The largest of the jointly-held fields, Ras Gharib, has slipped to 18,500 bbl. daily, while Hurghada produces only 600 bbl. daily. The three Socony fields, Sudr, Ras Matarma, and Asl, are all on Sinai, and produce 6,300 bbl. daily.

Going offshore . . . Egypt expects to be producing 110,000 bbl. daily by 1962, which will leave a net surplus of 30,000 bbl. daily available for export. ENI, as part owner of Eastern Petroleum, already is moving crude to Italy. The shipments last year averaged 22,400 bbl. daily.

Eastern Petroleum will take a look at the subsurface underneath the Gulf of Suez. It has obtained licenses on offshore areas adjacent to its existing acreage and plans to drill.

Algeria May Have New Field at El Agreb

A MAJOR new oil field appears to be shaping up in Algeria.

A stepout located 9 miles southwest of El Gassi 1 discovery has been brought in as a producer. Ste. Nationale des Petroles d'Aquitaine gave few details. But the well came in at 11,600 ft., the same depth range as the discovery, and presumably is in the same class.

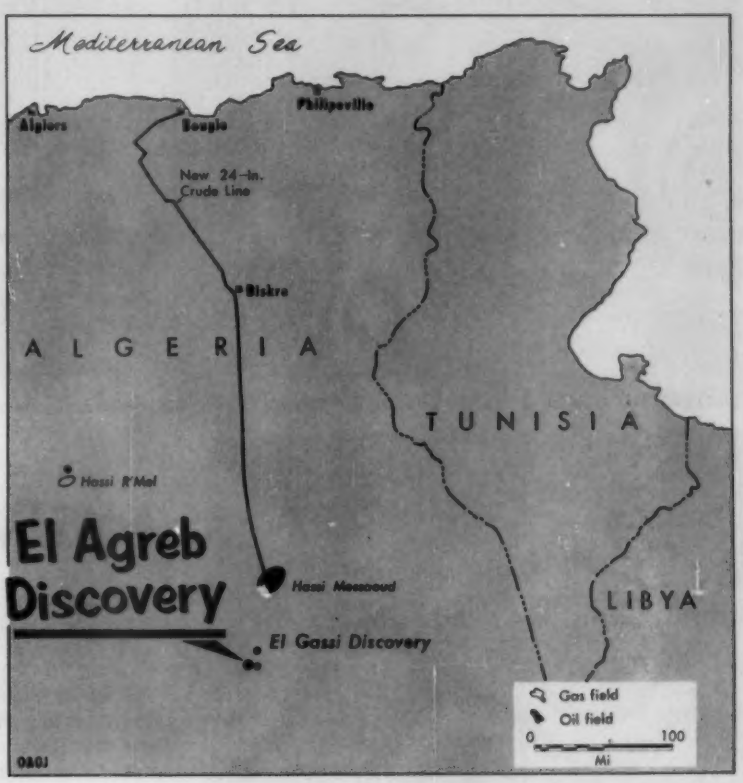
The name of the new find is El Agreb 1, but it is on the same large crescent-shaped structure as El Gassi 1. The initial discovery was made 50 miles south of the giant Hassi Messaoud field. The new field is not expected to be as big as Hassi Messaoud. But if it lives up to hopes, it still will merit the investment of millions for commercial development.

The discovery was completed earlier this year as a 2,540-bbl.-daily producer from a 295-ft. sandstone section at 10,740 ft. There are a number of similarities with Hassi Messaoud. Pay zones in both fields lie below 10,000 ft. The crudes are similar in many respects, including gravity, which is 44° API. The permeability and porosity of the pay zones is comparable. Bottom hole pressure of 6,330 psi. in El Gassi is in the same range as Hassi Messaoud.

SNPA has two rigs working on the find. The second outfit is drilling ahead at 4,900 ft. in another stepout, 6 miles south of the discovery.

El Agreb is a 557-sq.-mile tract adjoining the El Gassi tract on the southwest. The discovery was made in the extreme northwest corner of the El Gassi license, and the structure extends to the south and west onto El Agreb, and northward onto the Oued Mya license.

Oued Mya is held by SN Repal, one of the two operators of Hassi Messaoud. This company is moving in an Emsco JB 1250 heavy-duty rig from the Hassi Larroque structure to test El Gassi structure on its license area.



Lebanon Gets Play by German Firm

A NEW exploration play is shaping up in little Lebanon.

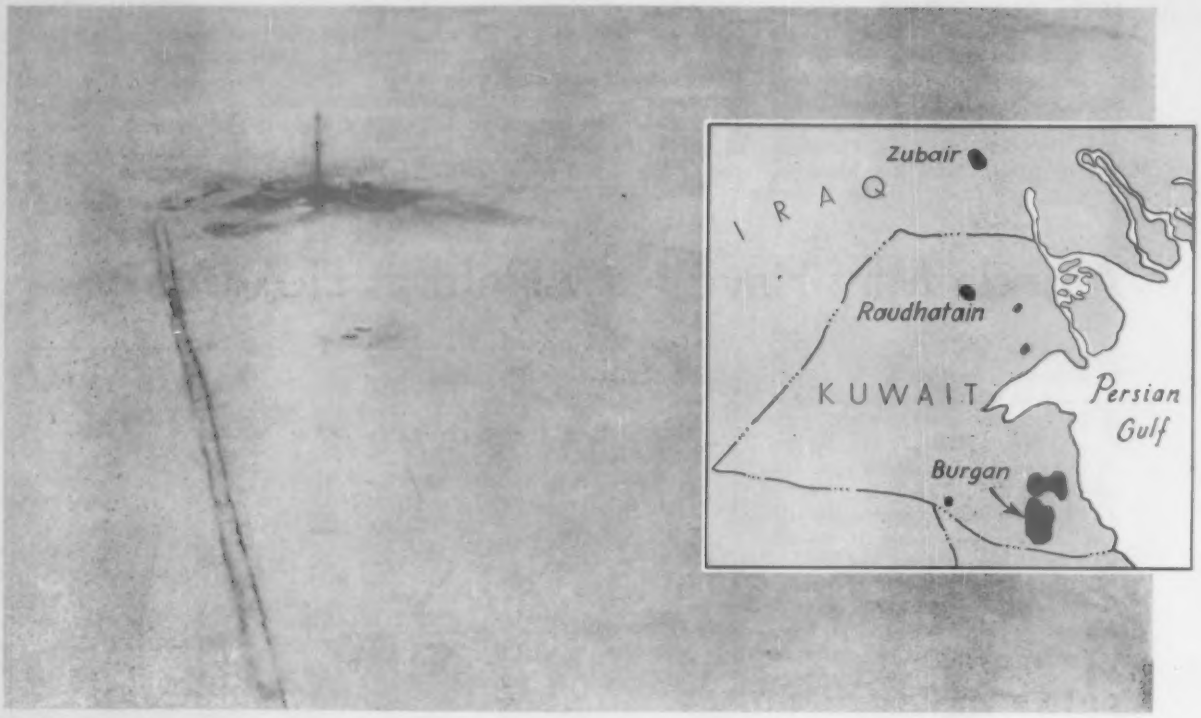
A West German company, Gewerkschaft Elwerath, is taking up an option to explore on license held by Cie Libanaise Des Petroles (CLP).

Under the terms of the agreement, Elwerath will buy shares in CLP worth $900,000, giving it half-interest. It also will carry out a geophysical survey and drill at least 13,000 ft. of hole in the next 12 months.

Two deep tests were drilled in earlier exploration programs in the tiny, 4,000-sq.-mile country, which has Mediterranean terminals for both Iraq Petroleum Co. and Trans-Arabian Pipe Line Co. pipeline systems.

A subsidiary of IPC gave up an exploration permit 12 years ago after abandoning a 10,059-ft. wildcat at Djebel Terbol. CLP then acquired licenses covering 1,275 sq. miles. Pacific Western Oil Corp., and C. B. Wrightsman, Houston independent, acquired half interest in the licenses, and helped finance a wildcat in South Bekaa.

The South Bekaa test encountered asphalt and a small amount of gas at 2,150 ft., but the well was bottomed at 8,867 ft. without finding anything commercial.



DRILLING RIG dots arid wastes of northern Kuwait where big Raudhatain field is being developed.

DESERT LIVESTOCK take advantage of a leak in a water tank at a Raudhatain well.

KUWAIT: Land of

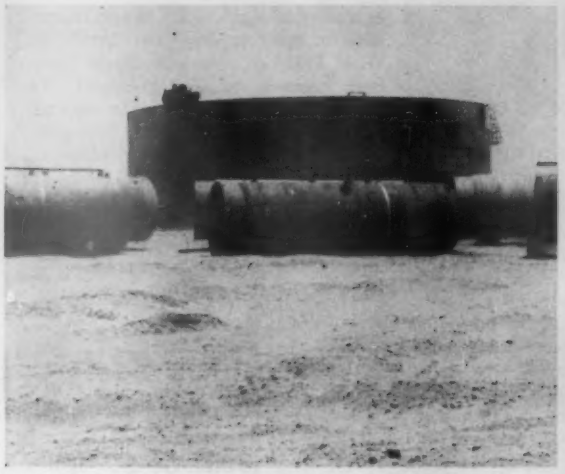
Paul Swain
International Editor

A FEW WEEKS ago an Iraqi Bedouin, with a typical tribesman's disdain for mundane political matters, drove his flock of sheep and goats across the Iraqi border into northern Kuwait. If he knew that the government of Kuwait looks askance at casual visitors from communist-tinged Iraq, it wouldn't have made any difference. He couldn't care less about the political differences of Kuwait Town and Baghdad or even Basra. Besides he was a long way from either place and he has, like his father before him, always moved his flock north or south looking for a little grass and water as the spirit or season moved him.

He didn't find much grass on the shamal-swept barrenness of Kuwait, but he did find a plentiful supply of water at a drilling rig developing Raudhatain, Kuwait's new big northern field.

"We're supposed to discourage that," Marvin Lester, Martha, Okla., toolpusher, commented as he watched the Arab family and its flock from the rig floor. "But what're ya gonna do? One of the tanks has a leak and the water's runnin' out on the ground anyway.

"They're not botherin' us anyway," he concluded with a grunt and turned back to watch the Italian drilling crew making a round trip on RA 24.



SAND STORM makes picture-taking difficult at the site of a pump station on a gathering line being laid from Raudhatain (top photo). Vertical separators are lying on the ground in front of a tank.

BIG CHUNKS of sand fused by the heat of a burning pit on a well are examined by two Kuwait Oil Co. engineers, Jeff Pryke, left, and H. K. Grant. Fused sand is seriously being considered as a road building material since rocks for road beds are scarce in the country.

Goats, Sand Storms—and Big Oil Fields

To the Iraqi Bedo, the big International Drilling Co. rig meant a ready water supply. To Lester and his Italian crew it's another contract drilling job. To Kuwait and the British-American oil company that bears its name, the big rig represents another well in a prolific oil field in a country that doesn't seem to have any other kind.

The field . . . Within the next few weeks, the 25-well field at Raudhatain will go on production. The initial flow of crude through a new 63-mile 30-in. pipeline will only be about 125,000 bbl. daily. This is no indication of the productive capacity of the field.

When RA 1 was bottomed at 10,301 ft. in October 1955 after first testing a thick Burgan pay, industry rumors and speculation about the find reached almost fantastic heights. The rumors were only intensified by the fact that neither Kuwait Oil Co. nor its parents, Gulf Oil Corp. and British Petroleum Co. would talk about the well or what it had found.

Like most of the wildest rumors that sometimes circulate in the oil business, some of those yarns about Raudhatain were at least partially true. It did have more than one pay. It tested commercial oil in sandstones from the deep lower Cretaceous Zubair sandstone series to the Upper Burgan.

But, Raudhatain was not destined to be a twin to the Zubair field less than 25 miles to the north across the Iraqi border. Only three of the wells later drilled in the field were completed in the Zubair.

Kuwait oil fell back on its tried and true Burgan sands in development wells. These wells probably average 300 net feet of pay sands and have tested all the way from 14,000 to 20,000 bbl. daily.

Raudhatain is a major oil field by any standards, but KOC officials in the field are a little derisive about those wild rumors about the discovery well.

"It's a good field, but it's no Burgan," says W. G. (Bill) Buie, assistant general manager.

But then few fields are "Burgans." Burgan furnished the bulk of the production when Kuwait topped 1,500,000 bbl. daily this spring.

New loading facilities . . . When the new field goes on production, its crude will move south through a newly completed 30-in. pipeline to the new North Tank farm. The new storage consists of 15 tanks, one of 210,000 bbl. and the rest with a capacity of 262,000 bbl. each. They are located on a 375-ft. elevation overlooking the sea and KOC's new North Pier.

Three 40-in. gravity flow lines link the storage with the pier and will give the terminal a loading rate of 50,000 bbl. an hour. Built in 65 ft. of water, the new pier can accommodate five medium tankers or two in the 100,000-ton class at the same time two smaller vessels are berthed.

Venezuela in a Bind

. . . as oil workers make stiff demands on industry already hit by tax boost. Government can't stand long oil strike.

VENEZUELA'S democratically-elected administration could be facing the most crucial test of its short life if oil workers stick by the new labor demands made last week.

Venezuela can't afford a prolonged oil industry strike. The industry, already hurt by a 10% tax increase, is unlikely to go along with the new labor demands. Labor leaders insist they'll stick by their guns because their demands are "all fair."

Labor's 165-clause, 50-page proposed contract was presented to oil companies last week after the primary demands were first made public by Fedepetrol (Venezuelan federation of oil workers).

Here are the primary demands:

. . . **A 40-hour week** with pay for 56 hours.

. . . **A 20% pay raise** for all oil workers paid less than $300 a month.

. . . **An 18% increase** for those paid from $300 to $450 a month.

. . . **A 15% pay raise** for those making from $450 to $600 a month.

. . . **A flat $100 monthly increase** for all who are paid $600 a month or more.

. . . **A minimum of $7.50** per day for all daily workers (compared with the $6 minimum now in effect) and a $180 per month minimum for all office workers.

. . . **Annual 30-day vacations** with 60 days pay. Oil workers now receive an extra 2 weeks pay if they take only a 2-week annual vacation.

. . . **A $3 daily housing** allowance for all workers not now living in company supplied homes. This allowance is $1.20 daily under the present contract.

. . . **Elimination** of all contractors. Fedepetrol blames contractors for much of the unemployment in Venezuela and theorize that if all work is done by company employes, the periodic layoffs will not be possible.

. . . **Job security** under which no worker could be fired with out the approval of a special commission made up of representatives of government, management, and labor.

. . . **Annual bonuses** (utilidades) equal to 10% of company profits with a minimum of 2 months pay. Under the present labor law, companies last year distributed more than $35 million in utilidades to workers in December.

The present 3-year labor contract expires October 19. The new contract proposed by labor would run 4 years.

New petroleum chamber . . . At just about the same time Fedepetrol was announcing its principal new demands to the Venezuelan press, the oil industry disclosed it has been doing a little organizing of its own.

Industry leaders denied flatly, however, that labor demands prompted the new organization. They say the new oil industry group's primary purpose is to cooperate with other similar industrial and business groups in the country and disseminate factual information about oil.

The Camara de la Industria del Petroleo's board of directors will be composed of Dr. Jose Giacipini Zarraga, (assistant to the president of Cia. Shell de Venezuela), president; Dr. Luis Alcala Sucre (Mene Grande director), vice president; G. W. Crickmay (Venezuelan Atlantic vice president and general manager), director; Dr. G. Rodriguez Eraso (Creole economist), director; Dr. Luis E. Arocha (Mobil Oil), director; Arthur A. Curtico (Signal Oil general manager), director; and Richard Wright (Texas Petroleum general manager), director.

New Strata Found in Sicily

TWO MORE oil-bearing structures have been located in the vicinity of Gela field, Sicily, but the commercial prospects still are not known.

ENI made the find in the Ponte Dirillo and Cammarata areas of southern Sicily, where it has been working intensely since the Gela discovery was made 2 years ago. Drilling from a three-legged LeTourneau barge off Gela has extended the field 30 to 40% above earlier estimates.

Nine wells have been completed this year in addition to 10 development wells drilled in 1958. Despite a production potential of several hundred barrels daily per well, the 8.8°-gravity crude is so heavy that pumps are required.

Pakistan Well Deepened

A SHALLOW gas zone in a West Pakistan wildcat has tantalized Standard-Vacuum Oil Co. into drilling three wells in search for oil on the same structure.

Stanvac is drilling ahead below 8,000 ft. in Mari 3, located 260 miles northeast of Karachi on the northernmost of the company's two blocks in West Pakistan. No oil shows have been encountered, but the well has passed through a gas horizon located in the initial wildcat.

The gas was noncommercial in Mari 1, abandoned at 11,110 ft. 2 years ago. The zone in the present well will not get a full-scale test for several weeks. Mari 2, also drilled in 1957, was bottomed at 10,468 ft. The gas comes in from 2,200 to 2,400 ft.

Libya Snubs Cash

. . . from Russia in favor of oil firms' 50-50 split.

LIBYA HAS NO PLAN to seek an increase in its 50-50 split with foreign oil interests, according to the Libyan ambassador to the UN and U. S.

Dr. Mohieddine Fekini gave this reassuring note at Houston last week during a swing through the oil country.

"The declared policy of the Libyan Government is to respect its obligations contained in the current concessions," Fekini said.

Further, he added, Libya has "no idea" of asking more than 50% of net profits for future negotiated concessions.

Dr. Fekini said Libya is jealous of its independence and has no thought of joining the Egyptian-sponsored United Arab Republic or becoming indebted to the Soviet Union.

While the Russians have offered financial assistance to Libya, a newly rich oil country, they have not found a taker in the Libyan Government.

Instead, Libya is encouraging continued investment by western nations and now has some 12 U. S. oil companies operating in the country.

Italians Busy in Iran

ENI expects to have both onshore and offshore wildcats making hole in Iran by the end of the year. SIRIP, the jointly-owned subsidiary of Italy's state company and National Iranian Oil Co., plans to start a well in the eastern Zagros mountains in December.

The test will be on a 4,360-sq.-mile concession adjacent to the consortium area, east of Agha Jari, Haft Kel, Naft Safid, and Masjid-I-Sulaiman oil fields.

A wildcat near the northern edge of a 2,160-sq.-mile tract in the northern Persian Gulf is scheduled to start in a few months.

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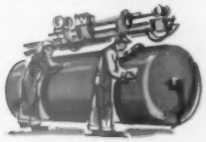
ENGINEERING



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PETROCHEMICALS ... an annual report

U. S. petrochemicals reach new peak

• By 1965 the demand for petroleum chemicals will grow to 85 billion pounds with value in excess of 10 billion dollars. Present product uses will expand; there will be entirely new resins, fibers, synthetic fuels, and lubricants.

BY DR. R. L. BATEMAN
Director of Market Development,
Union Carbide Chemicals Co.,
New York City

PRELIMINARY estimates for 1959 point to another all-time high for petrochemicals. Production should total 48.8 billion pounds—an increase of 15.5% over 1958 (Table 1). The upsurge in the over-all economy, which began in mid-1958, is apparent in the production figures for the entire chemical industry. These will show a gain of 14.5% for 1959 over 1958 (174 billion pounds vs. 152 billion). Since the strong demand is benefiting all segments of the chemical industry, the petrochemical share of the total remains unchanged at 28%, the same as 1958.

How Much in '59?

The value of petrochemicals produced in 1959 will increase 17.5% to 6 billion dollars (Table 1). This is equivalent to 57.7% of the production value of all chemicals. It is now apparent that the petrochemical share of the over-all industry is gaining very slowly. A large tonnage of inorganic chemicals is required in the synthesis and upgrading of petrochemical olefins—and, therefore, the increase in petrochemical production brings with it a concurrent expansion for many basic inorganic chemicals.

The construction expenditures estimate released by the Manufacturing Chemists' Association in March 1959 emphasizes this interrelationship. For this period 1958-1960 MCA estimates an expenditure of 1.04 billion dollars for general organic and petrochemical facilities and an expenditure of 800 million dollars for general inorganic facilities.

These are good yardsticks for the relationship since it usually requires somewhat more than $1.00 of plant investment to obtain $1.00 of annual sales of organics including petrochemicals, and somewhat less plant investment for each dollar of annual sales of inorganics.

Overcapacity Less Serious

Surplus capacity is not a serious problem to the petrochemical industry in 1959. Nevertheless, some surplus plant still exists for those petrochemicals that were operating at the lowest rates in 1958. In this category are methanol, ammonia, ethylene oxide, vinyl chloride, and styrene. Based upon the presently authorized expansions, it appears that other products may come into an oversupply position in the near future.

In many cases, this situation will occur from increasing participation of processes that, in the past, were based predominantly on nonpetrochemical raw materials. The projected expansions for maleic and phthalic anhydrides, for vinyl acetate, and for acrylonitrile should prevent any shortage of these chemicals in the next 3 to 5 years.

Relative Growth

A closer study of the three types of petrochemicals — aliphatics, aromatics, and inorganics—reveals that the aliphatics are still the largest, and, tonnagewise, will have the greatest 1958-1959 gain of 3.7 billion pounds, equal to 14%. The smallest segment—the aromatics—will experience the greatest percentage growth—a 26.5% increase—although the tonnage moves only to 5.7 billion pounds from 4.5 billion (Table 2).

The increased reliance on petrochemical benzene and xylenes for the expansions in polyester fibers and resins, the polyurethane resins, maleic and phthalic anhydrides, at the expense of coal-tar raw materials, is evident here. The increase in production of petrochemical inorganics is largely concentrated in the greater output of ammonia from plant facilities already in existence.

Also contributing to the greater petrochemical ammonia output was the shutdown of a large ammonia facility based on coal raw materials.

More Olefins

A prime assurance of continued growth of petrochemicals in the 1960's is the many authorized expansions for production of olefin raw materials. Usually **ethylene** and **propylene** are thought of as the most important raw materials. The **higher olefins**, particularly **butylenes** already have a prominent place and are likely to continue their growth as important starting materials.

Butylenes for butadiene production has put the C_4 olefins in second place behind ethylene and ahead of propylene (see Table 3). In addition to butadiene, the C_4 olefins have been the raw materials for butyl rubber, methyl ethyl ketone and secondary butanol.

TABLE 1—U. S. PETROCHEMICALS PRODUCTION—1959 VS. 1958

In Billions of Pounds

Petrochemicals:	1957	1958	Per cent change 1957-58	Est. 1959	Per cent change 1958-59
Aliphatics	25.9	26.4	1.5	30.1	14.0
Aromatics	3.7	4.5	21.5	5.7	26.5
Inorganics	10.7	11.3	6.0	13.0	14.5
All petrochemicals	40.3	42.2	4.5	48.8	15.5
All chemicals	149.0	152.0	2.0	174.0	14.5
Petrochemicals as per cent of all chemicals	26.8	27.7	....	28.0	....

In Billions of Dollars

Petrochemicals:	1957	1958	Per cent change 1957-58	Est. 1959	Per cent change 1958-59
Aliphatics	$3.89	$3.95	1.5	$4.51	14.0
Aromatics	0.63	0.76	20.5	0.97	27.5
Inorganics	0.41	0.41	....	0.53	29.0
All petrochemicals	$4.93	$5.12	4.0	$6.01	17.5
All chemicals	$8.79	$9.19	4.5	$10.40	13.0
Petrochemicals as per cent of all chemicals	56.0	55.7	....	57.7	....

TABLE 2—PETROCHEMICALS—PRODUCTION AND GROWTH RATES
(Production in billions of pounds)

	Aliphatics	Aromatics	Inorganics	Total petrochemicals
1945	5.4	1.4	2.35	9.15
1950	11.8	0.95	3.4	16.1
1955	20.4	3.2	9.5	33.0
1958	26.4	4.5	11.3	42.2
1959*	30.1	5.7	13.0	48.8
1960†	35.0	6.3	13.7	55.0
1965†	60.0	8.0	17.0	85.0
Growth Rate Per Cent Per Year				
1945-1950	17.0	(‡)	8.0	12.0
1950-1955	11.6	28.0	23.0	15.0
1955-1960	11.6	13.4	7.6	10.7
1960-1965	10.8	10.0	4.4	9.2

*Preliminary. †Estimated. ‡Decrease.

TABLE 3—U. S. OLEFIN DEMAND
(In millions of pounds)

	1950	1955	1958	1959	1960	1965
Ethylene (total)	1,500	3,000	4,200	4,500	5,000	7,000
"Chemical" ethylene*	1,400	2,500	3,300	3,400	3,800	5,200
Propylene (total)	900	1,400	1,900	1,950	2,000	2,800
Butylenes	1,250	2,550	2,650	3,100	3,490	4,300

*Excludes polyethylene requirements.

Growth Rate Per Cent Per Year

	1955-1960	1960-1965
Ethylene	10.7	7.1
Propylene	7.4	7.1
Butylenes	6.6	4.4

C_4 and Higher Olefins

These higher olefins have been studied even more extensively by the research and development laboratories of the industry in the 1950's. It is likely that important segments of such research efforts will be translated into plant facilities in the 1960's. The broadening of the chemical use of C_4 and higher olefins will contribute to their growth in the coming decade. Greater utilization of the oxo process for the synthesis of higher alcohols, aldehydes, and acids is already of significance.

A new synthesis of methacrylic acid and methacrylates via the oxidation of isobutylene introduces the C_4 olefin as raw materials for products previously based upon propylene. The supply of isoprene for the "synthetic" natural rubbers will need to be supplemented by direct synthesis, one of which may utilize isobutylene and formaldehyde. Tertiary butyl acetate, under development as a tetraethyl lead "appreciator," is another potential application for isobutylene.

The Plastics Industry

Plastics continue to be the most spectacular and dynamic outlet for petrochemical raw materials.

- **Polyethylene,** in 1959, will become the first billion-pound plastic and there is no indication that its meteoric growth is slackening.
- **Other plastics** whose properties and broad utilization indicate bright prospects for the future include the polyurethane resins. These are synthesized from polyethers or polyesters made from the aliphatic raw materials, and the aryl isocyanates which has toluene as the starting raw material.
- **The laboratories** of the chemical industry are also developing synthetic resins that possess properties comparable in many respects to such metals as zinc, steel, brass, and aluminum. In this family are included the polyformaldehyde resin, offered under the trade name "Delrin," and the polycarbonates under several new trade names. These give promise of opening additional new fields largely untapped by petrochemicals.

Petrochemicals in '65

By 1965, the demand for petrochemicals will grow to 85 billion pounds with a value in excess of 10 billion dollars. The increasing expenditures for research, both basic and application in nature, will lead to expansion of uses for present products and entirely new resins, fibers and synthetic fuels and lubricants.

Changing energy pattern sponsors

Europe's petrochemical growth

• Growing productivity of Europe's petrochemical industry will, in the near future, satisfy domestic demands; surpluses will probably be available for the world market.

BY HOWARD A. KIRSCH AND DR. W. E. KUHN
Texaco, Inc.

WHILE COAL still remains the largest source of energy in the free-European economy, the past decade has witnessed an increasing dependence upon petroleum and natural gas. Evidence of this is shown in Table 1.

It may be seen that in 1948, petroleum and natural gas supplied only about 8.7 and 0.1%, respectively, of free Europe's energy requirements. In 1957 these two sources had grown to where they were supplying about 17.8 and 1.2% of the total requirements. Meanwhile, hard coal's portion of the energy picture has dropped from about 80.8% of the 1948 total to approximately 69.9% in 1957. The other primary energy sources have essentially maintained their share of the energy market.

Crude-Oil Imports

Since at present free-European countries* produce only about 12 million metric tons† of crude, it is necessary that this area rely heavily upon imports to satisfy annual crude oil demands which in 1958 reached about 141 million metric tons. Data for the production, importation, and exportation of crude petroleum by free Europe during the 1948-1957 period are shown in Fig. 1. Crude imports have increased rapidly from about 18.5 million metric tons in 1948 to about 108 million metric tons in 1956. Due to the Suez Canal incident, the 1957 imports remained approximately at the 1956 level but in 1958 resumed the generally expanding trend reaching about 130.5 metric tons. The free-European crude-oil exports recently amounting to 1.0-1.3 million metric tons annually are a result of Russian reparations imposed on Austria which is the source of this material.

Middle East Sources

At the present time, over 80% of the crude imported by free Europe comes from Middle Eastern fields. In the future, French territories in Africa are expected to become an increasingly important source of crude supplies.

The increasing demands for petroleum products in Europe, accompanied by the availability of Middle Eastern and African crudes, has resulted in a large increase in European crude runnings. Some idea of the expansion in crude runnings may be

Howard A. Kirsch is a research chemical engineer in the chemicals research department of Texaco, Inc.'s research center at Beacon, N. Y. He is a native of Cincinnati, and obtained his degree in chemical engineering from University of Cincinnati.

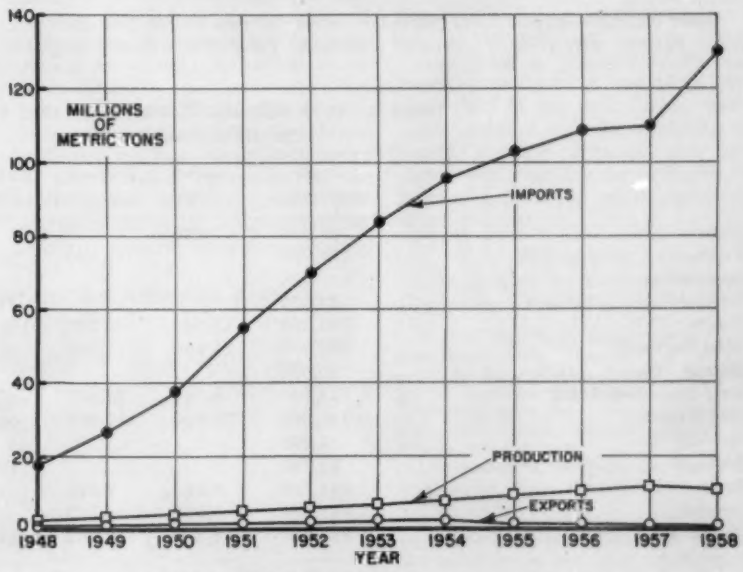
Dr. Wayne E. Kuhn is general manager of the research and technical department of Texaco. He is a well-known authority in the petrochemical field and is currently president of the American Institute of Chemists.

*The countries considered are shown in Table 2. †Basis factor of 6.902 bbl. equal 1 metric ton.

TABLE 1—PERCENTAGE OF EUROPEAN ENERGY REQUIREMENTS SUPPLIED BY VARIOUS SOURCES

	1948	1957
Hard coal	80.8	69.9
Brown coal	8.4	8.6
Hydroelectric power	2.0	2.5
Natural gas	0.1	1.2
Petroleum	8.7	17.8
Total	100.0	100.0

Source: OEEC.[1]



CRUDE PETROLEUM supply in free Europe. Fig. 1.

obtained from the data shown in Fig. 2 which show the annual refinery throughput in free Europe during the 1948-1958 period. During this period, refinery runs have grown from about 19.5 to about 141 million metric tons—an increase of over 620%. In the future, growing demands and the ready availability of crude are expected to result in even further expansion in European crude runnings.

Crude Throughput

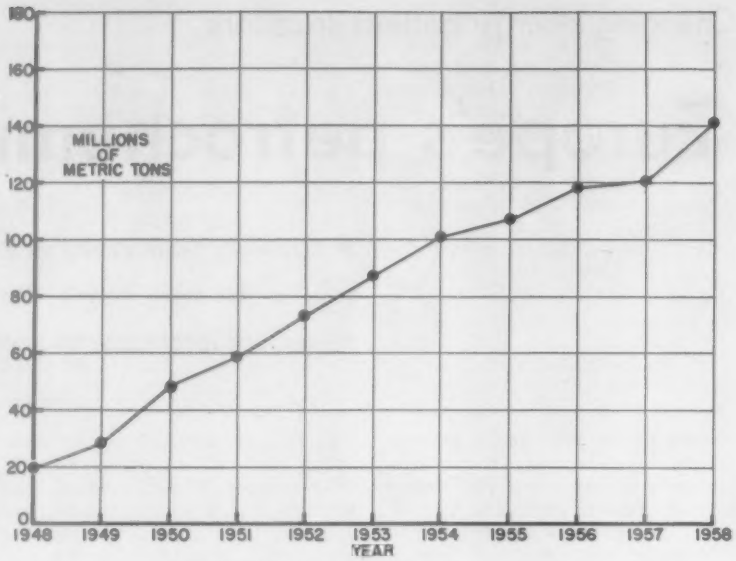
The 1959 crude throughput capacity of free-European countries has been estimated at about 3.6 million barrels per day (about 190 million metric tons per year). Table 2 shows a breakdown of this capacity by country as well as the types and capacities of processing downstream from the crude units. It may be seen that sizable cracking, reforming, and polymerization facilities are in operation.

These latter operations are the sources of raw materials which have encouraged the growth of free Europe's petrochemical industry. The gaseous hydrocarbons, ethylene, propane, propylene, butanes, and butylenes available from cracking operations are of particular interest as raw materials for the manufacture of a wide variety of chemical products.

Catalytic reforming operations are the source of the basic aromatic chemical building blocks, benzene, toluene, and xylenes, as well as a source of hydrogen for the production of ammonia and nitric acid.

Polymerization operations produce high-molecular-weight olefins for use in the preparation of synthetic detergents, lubricating-oil additives, and oxo products.

Other materials derived from petroleum streams are also of chemical importance. These include sulfonates, naphthenic acids, cresylic acids, hydrogen sulfide, carbon dioxide, and specific petroleum fractions which can be converted to carbon black, hydrogen, resinous products, or further processed to yield specific chemical raw materials.



FREE EUROPEAN refinery throughput. Fig. 2.

The OEEC reports[4,5] on "The Chemical Industry in Europe" give some estimates of the raw materials employed by the petrochemical industry. Data for 1954 and 1957 are shown in Table 3.

The heavy dependence on petroleum-derived feed stocks is apparent from the data in this table.

A Growing Petrochemical Industry

Thus we can see in free Europe's growing petroleum industry a growing availability of raw materials for chemical conversion and consequently a growing petrochemical industry. Evidence of the activity in Europe's petrochemical industry may be seen particularly in the United Kingdom, France, West Germany, Italy, and the Netherlands.

● **In England,** the Esso refinery at

TABLE 3—RAW MATERIALS EMPLOYED BY EUROPE'S PETROCHEMICAL INDUSTRY

(Thousands of metric tons)

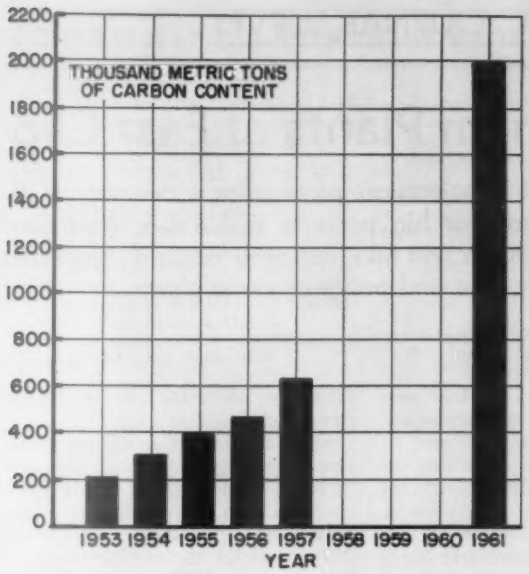
	1954	1957
Petroleum	692	*1,110
Refinery gas	349	924
Natural gas	66	180.5

*Excludes consumption of oil in Germany.

TABLE 2—1959 REFINING CAPACITY IN FREE EUROPE[3]

(Barrels per stream day)

	Crude distillation	Thermal cracking	Thermal reforming	Catalytic cracking	Catalytic reforming	Hydro-treating	Poly-merization
Austria	49,310	11,000	.....	.....	.....	.....	.....
Belgium	175,900	.....	13,160	25,100	18,850	10,000	1,900
Denmark	630	.....	.....	.....	.....	.....	.....
Finland	23,000	.....	.....	12,800	3,400	.....	500
France	713,200	15,000	84,200	134,450	42,900	830	10,380
West Germany	406,570	21,900	11,300	66,200	54,200	49,700	2,390
Greece	30,000	.....	.....	.....	8,200	.....	.....
Italy (including Sicily)	722,900	16,100	39,870	40,700	82,720	23,250	5,730
Netherlands	349,000	29,000	10,000	66,000	27,700	36,200	950
Norway	2,000	.....	.....	.....	.....	.....	.....
Portugal	22,900	.....	.....	10,600	.....	.....	1,400
Spain	144,700	3,500	9,000	.....	16,000	.....	460
Sweden	47,850	1,000	6,300	.....	5,500	.....	.....
United Kingdom	917,900	8,300	48,000	129,000	59,900	29,500	6,200
Total	3,605,860	105,800	221,830	484,850	319,370	149,480	29,910



PETROCHEMICAL production in free Europe. Fig. 3.

Fawley, British Petroleum Co.'s refinery at Grangemouth, and Shell's refineries at Stanlow and Shell Haven have provided the raw materials for growing petrochemical activities. These activities include products such as polyethylene, ethylene oxide, ethylene glycol, styrene, ethyl alcohol, styrene-butadiene rubber (SBR), detergent alkylate, and acrylonitrile.

● **In France,** the Esso refinery at Port Jerome, Shell's Berre-l'Etang refinery, Compagnie Francaise de Raffinage's refinery at Gonfreville, and the Société-Francaise de Petroles B.P. refinery at Le Havre are the sources of raw materials for a rapidly growing petrochemical industry. Products of this industry include carbon black, styrene-butadiene rubber, butyl rubber, polyethylene, detergent alkylate, ethylene oxide, ethanolamines, isopropyl alcohol, methylethyl ketone, and aromatics.

● **Although West Germany's** organic chemicals industry has been based largely on coal-derived raw materials, the U. S. Department of Commerce estimates that in West Germany, 1957 production of polyethylene, polystyrene, synthetic rubber, phenol, detergent alkylate, plasticizers, and solvents consumed about 20,000 metric tons of crude oil and oil products, 50,000 metric tons of natural gas, and 185,000 metric tons of refinery gases.

German companies which are active in petrochemical operations include Farbwerke-Hoechst A. G., Farbenfabriken Bayer, British Petroleum A. G., Esso A. G., Badische Anilin- and Soda-Fabrik A. G. and Deutsche Shell A. G.

● **In Italy,** petrochemical operations are based largely upon natural gas available from existing fields. About 9% of domestically produced natural gas is used in chemical production. The heavy dependence on natural gas is consistent with Italy's comparatively large proven gas reserves. Azienda Nazionale Idrogenozione Combustili's (ANIC) 30,000-ton synthetic rubber plant at Ravenna (officially opened in April 1958) was originally scheduled to use petroleum-refinery coproducts as raw materials.

This plan was changed to use natural gas as the raw material when it appeared unlikely that Italian oil refineries could provide enough coproducts to meet requirements. Apparently, however, a plant is planned at Ravenna to produce sizable quantities of butadiene from petroleum refinery butane[6].

● **In Holland,** Royal Dutch-Shell, using raw materials from its refinery at Pernis, has been particularly active in petrochemical operations in the Netherlands. Shell is presently producing epoxy resins, epichlorohydrin, synthetic glycerin, detergent alkylate, polyvinyl chloride and other products. Styrene-butadiene rubber producing facilities using raw materials from Shell's Pernis refinery are planned by Shell, Goodrich Chemical Co., and Algemeine Kunstzijde Unie.

TABLE 4—INVESTMENTS IN EUROPEAN PETROCHEMICAL FACILITIES
(Millions of U. S. dollars)

	Dec. 31, 1957	End of 1960	Per cent expansion
France	69	280	306
West Germany	173	293	69
Italy	78	188	141
Netherlands	16.5	23	39
United Kingdom	212	393	85
Total	548.5	1,177	115

Source: U. S. Department of Commerce.[5]

European Petrochemical Investment

The vitality of the European petrochemical industry is evidenced by the growth in total investments. In terms of U. S. dollars, the petrochemical industry in the five European countries most active in this area has grown from an estimated 240 million dollars on July 1, 1953, to about 549 million dollars on December 31, 1957. Planned expansions in facilities are expected to increase total investment to about 1.2 billion dollars by the end of 1960. Table 4, shows a breakdown of these investments by country.

The effect of this growing investment on production is illustrated in Fig. 3. It may be seen that, in terms of carbon content, petrochemical production in the five countries considered in Table 4 has grown from about 208,000 metric tons in 1953 to approximately 630,000 metric tons in 1957. The increased investment anticipated for the industry by the end of 1960 is expected to raise annual production to a total of about 2 million metric tons.

Major areas included in this expansion are synthetic rubber, polyethylene, ethylene oxide and derivatives, polypropylene, and raw materials for plastics and solvents.

This contemplated expansion in petrochemical production will in turn result in heavy demands for petroleum and natural-gas-derived raw materials. Where petroleum refinery coproducts, as such, are insufficient, selected fractions will be further processed to yield specific raw materials.

The growing productivity of Europe's petrochemical industry indicates that, in the near future, sufficient capacity will be available to satisfy domestic demands and surpluses will probably be available to permit more active participation in world markets.

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5. Organization for European Economic Cooperation, "The Chemical Industry in Europe, 1958."
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World Is Building Petrochem Plants at Fast Clip

• More than 150 projects are planned or under way. U. S. is still in the lead, but big projects in Europe, Australia, Japan, and Argentina will hike capacity abroad. Emphasis is on new polyethylene and polypropylene plants.

THE U. S. is still the No. 1 petrochemical producer, but the rest of the world is taking giant steps to meet the increasing demand for petroleum-derived products.

An exhaustive Journal survey of world-wide petrochemical activity shows at least 150 expansion or new-construction projects either under way or planned by various petrochemical companies. More than 100 of these are in the free world outside the U. S. and Canada.

There is an emphasis on construction of new polyethylene and polypropylene production facilities. Of the more than 50 construction projects in the U. S. and Canada, more than a dozen are for new polyethylene and polypropylene facilities. And at least 24 such projects are scheduled abroad.

Activity in Europe . . . Western Europe is busy trying to catch up with the U. S. in petrochemical production capacity. Most of the construction and expansion is in such countries as France, Italy, and England.

At least a dozen projects are being considered or are under way in France. United Kingdom has seven in the mill, including Imperial Chemical Industries' long-term plans for a $282-million complex near Avonmouth.

Italy's projects include one of Europe's largest, Montecatini's construction program at Brindisi. Work has already started on the $95-million complex where at least 1,300,000 tons of raw materials will be used annually for production of various petrochemicals.

Western Europe and North America are not the only two areas where petrochemical capacity is growing. Australia, Japan, and Latin America are all increasing capacity. A half-dozen projects are under way or planned in Australia, and about as many are planned or started in Japan.

Argentina's new policy of letting more foreign capital into the country is reflected in construction of at least seven petrochemical plants.

Invasion of U. S. . . . At least two prominent European companies are building plants in the U. S.

Novamont Corp., a subsidiary of the big Italian firm Montecatini, is scheduled to complete a new plant at Neal, W. Va., within 2 years.

The $10-million plant will have capacity of 10,000,000 lb. annually of polypropylene and other polyolefins.

Dow Badische Chemical Co., owned jointly by Dow Chemical Co. and the well-known German firm, Badische Anilin- and Soda-Fabrik, AG, is building a new plant at Freeport, Tex. The facilities for manufacture of products derived from acetylene are scheduled for completion late this year.

Other U. S. Projects . . . Beaumont, Tex., will be the site of the world's largest ethylene plant.

Magnolia Petroleum Co. will spend $25 million to build new facilities at Beaumont for production of ethylene, propylene, and butadiene, with completion scheduled in 1961.

Sohio Chemical Co. will use a new simple single-step conversion process to make acrylonitrile at a new plant at Lima, Ohio. It's scheduled for completion in 1960.

The Journal survey also indicates that "man-made" natural rubbers, such as the polybutadiene and polyisoprene types, are beginning to move from the pilot stage into commercial field.

In the following world-wide table, existing as well as proposed plants in the U. S. are listed first, followed by Canada, then the rest of the world in alphabetical order.

Because of the big number of plants and projects in the U. S., this portion of the table is divided into five parts for quick reference: organics, nitrogen chemicals, butadiene and copolymer, sulfur conversion, and carbon black.

PETROCHEMICAL PLANTS IN THE U. S.

PART 1—ORGANICS

A

ALLIED CHEMICAL CORP., National Aniline Division, Buffalo, N. Y.
Raw material: Kerosine fraction and white-oil fraction.
Principal products: Alkyl aryl sulfonates (water soluble), long-chain alkyl aryl sulfonates (oil soluble), and dodecylbenzene.

ALLIED CHEMICAL CORP., Nitrogen Division, Orange, Tex.
Raw material: Ethylene.
Principal products: Ethylene glycol, ethylene oxide, and ethanolamines.

ALLIED CHEMICAL CORP., Plastics and Coal Chemicals Division, Frankford, Pa.
Raw material: Propane-propylene blend.
Principal products: Phenol and acetone.

ALLIED CHEMICAL CORP., Semet-Solvay Petrochemical Division, Tonawanda, N. Y.
Raw material: Ethylene (from residual oil fraction).
Principal products: Polyethylene resin pipe compound and high melting point polyethylene wax.
Construction: Plans call for increasing capacity 50% or a total of 30,000,000 lb. per year.

ALLIED CHEMICAL CORP., Semet-Solvay Petrochemical Division, site undetermined.
Construction: Proceeding with design of a new polyethylene plant to produce both low and high-molecular-weight polymers. This will be located in an area where ethylene is readily available in substantial quantities.

ALLIED CHEMICAL CORP., Solvay Products Division, Moundsville, W. Va.
Raw material: Methane (natural gas).
Principal products: Methyl chloride, methylene chloride, choloroform, and carbon tetrachloride.

ALOX CORP., Niagara Falls, N. Y.
Raw material: Petroleum fractions.
Principal products: Oxygenated petroleum

chemicals for rust preventives, lube-oil additives, mixtures of organic acids, and other oxygenated hydrocarbons.

AMERICAN CHEMICAL CORP. (Richfield Oil Corp. and Stauffer Chemical Co.), Long Beach, Calif.
Construction: New facilities are being built for production of ethyl chloride, ethylene dichloride, and vinyl-chloride monomer. Completion of this $7.5-million project is scheduled in January 1960. In addition, a unit for production of vinyl-chloride polymer will be completed about April 1960.

AMERICAN CYANAMID CO., Escambia Bay, Fla.
Principal product: Acrylic fiber (27,000,000 lb. per year).

AMERICAN CYANAMID CO., Fortier plant, Avondale, La.
Raw material: Natural gas.
Principal products: Hydrocyanic acid, acrylonitrile (100,000,000 lb. per year), monomethyl styrene, and acetylene (used internally).
Construction: Facilities for acrylonitrile derivatives in planning and development stage.

AMERICAN CYANAMID CO., Warners, N. J.
Raw material: Petroleum fractions.
Principal products: Oil-layer type of petroleum sulfonate (barium salt).

AMERICAN OIL CO., El Dorado, Ark.
Raw Material: Refinery streams.
Principal product: Polybutenes.

AMERICAN OIL CO., Texas City, Tex.
Raw material: Refinery streams.
Principal products: Benzene, nonene, heptene, and aromatic solvents.

AMERICAN OIL CO., Yorktown, Va.
Raw material: Refinery streams.
Principal products: Polybutenes.

AMOCO CHEMICALS CORP., Joliet, Ill.
Raw material: Petroleum aromatics.
Principal products: Phthalic anhydride, Isophthalic acid, terephthalic acid, dimethyl terephthalate, dimethyl isophthalate, and benzoic acid.
Construction: New plant for production of polystyrene is scheduled for completion in 1961.

AMOCO CHEMICALS CORP., Texas City, Tex.
Raw material: Petroleum fractions and refinery gases.
Principal products: Benzene-2° (1,000 bbl. per day), toluene, zylenes, hydrocarbon resins (petroleum polymer and condensation resins), aromatic solvents, drying oils, alkylated naphthalenes, nonene, and methyl mercaptan.

ATLANTIC REFINING CO., Atreco, Tex.
Raw material: Petroleum fractions, refinery gases, and solvent extracts.
Principal products: Detergent alkylate (from benzene and propylene tetramer), diisobutylene, and triisobutylene.

ATLANTIC REFINING CO., Philadelphia.
Raw material: Crude petroleum fractions, refinery gases, and solvent extracts.
Principal products: Aromatic solvents, crude carbolates, crude cresylic acid, technical eicosane, nonene, crude mercaptans, alkylbenzene, and dodecylbenzene sulfonic acid type of water-soluble alkyl aryl sulfonates.
Raw material: Asphalt.
Principal product: Thermoplastic resin.

ATLAS PROCESSING CO., Shreveport, La.
Raw material: Field condensates and debutanized 400° F. end point naphtha from gas-processing plants.
Product: 600 bbl. of benzene is produced with 15,500 bbl. daily of motor fuel.

AURORA GASOLINE CO., Detroit.
Raw material: Naphtha fraction.
Principal product: Mixed aromatics (3,850 bbl. per day).

AVISUN CORP. (Sun Oil Co. and American Viscose Corp.), New Castle, Del.
Construction: Pilot plant and film plant for production of film, filament, and staple fibers, using polypropylene resins as raw material: Pilot plant, scheduled for completion in early fall 1959, will have capacity of 500,000 lb. per year. Film plant will have capacity of 10,000,000 lb. per year. Project will cost several million dollars.

AVISUN CORP. (Sun Oil Co. and American Viscose Corp.), Port Reading, N. J., at facilities leased from Koppers Co. Inc.
Construction: Koppers facilities are being converted by AviSun for production of polypropylene resins from olefins. Capacity is 20,000,000 lb. per year. Completion is expected by mid-1959.

B

BARIUM REDUCTION CORP., South Charleston, W. Va.
Raw material: Natural gas.
Principal products: Carbon disulfide and hydrogen sulfide.

C

CALCASIEU CHEMICAL CORP. (Cities Service Co., Continental Oil Co., Mineral Industries, Inc., and Sears, Roebuck & Co.), operated by Petroleum Chemicals, Inc.), Lake Charles, La.
Raw material: Ethylene oxide.
Principal products: Ethylene glycol (8,000,000 gal. per year) and glycol sludge (775,000 gal. per year).

CALIFORNIA-SPRAY CHEMICAL CORP. (subsidiary of California Chemical Co.), Richmond, Calif.
Raw material: Petroleum bases.
Principal products: Summer and winter oil sprays, aromatic solvents, spray detergents, and emulsifiers.

CALLERY CHEMICAL CO., Muskogee, Okla.
Raw material: Natural gas and boric acid.
Product: High-energy fuel.
Status: This plant is essentially completed and will be in operation this fall. The $38-million plant was built and will be operated under Navy contracts.

CELANESE CORP. OF AMERICA, Bishop, Tex.
Raw material: Natural gas and liquefied petroleum gases (propane and butanes).
Principal products: Propylene oxide, propylene glycol, dipropylene glycol, 1,3-butylene glycol, 2,3-butylene glycol, acetone, methanol, formaldehyde, formaldehyde solutions in alcohols, paraformaldehyde, trioxane, acetaldehyde, acetic acid, n-propanol, isobutanol, n-butyl alcohol, special solvents, n-propyl acetate, pentaerythritol, butyraldehyde, 2-ethyl butanol, crotonaldehyde, and trimethylolpropane. (Oxygen unit has been added to this plant.)

CELANESE CORP. OF AMERICA, Houston.
Raw material: Ethylene and alpha olefins.
Principal product: Low-pressure polyolefin (40,000,000 lb. per year).

CELANESE CORP. OF AMERICA, Pampa, Tex.
Raw material: Natural gas and liquefied petroleum gas (propane and butanes).
Principal products: Propionic acid, methanol, acetone, acetic acid, acetic anhydride, vinyl acetate, n-propyl acetate, n-butyl acetate, butyric acid, methyl acetone, acetate methylal, methyl ethyl ketone, and ethyl acetate.
Raw material: Beta-propiolactone.
Principal products: Ethyl acrylate and methyl acrylate (13,000,000 lb. per year).
Construction: Capacity of acetic-acid plant will be doubled, boosting total capacity to 240,000,000 lb. per year, with completion scheduled late 1959.

CELANESE CORP. OF AMERICA, Point Pleasant, W. Va.
Raw material: Petroleym cresylic acid, phenol, propyl alcohol, ethylene oxide, butyl alcohol, isooctyl alcohol, and pentaerythritol.
Principal products: Tricresyl phosphate, dialkyl phosphate, polyester plasticizers, phenyl discresyl phosphate, chlorinated phosphates, pentaerythritolesters, and flame resistant hydraulic fluid.

CHEMSTRAND CORP. (Monsanto Chemical Co., and American Viscose Corp.), Decatur, Ala.
Raw material: Acrylonitrile.
Principal product: Acrylic fibers (45,000,000 lb. per year).

CHEMSTRAND CORP. (Monsanto Chemical Co. and American Viscose Corp.), Pensacola, Fla.
Raw material: Petroleum-base stocks.
Principal product: Nylon (114,000,000 lb. per year).

COLUMBIA GAS SYSTEM, INC., Siloam, Ky.
Construction: This company has a fractionation plant in operation at Siloam and is actively seeking a customer interested in the purchase of ethylene from production facilities to be added to the present plant. United Fuel Gas Co. furnishes hydrocarbons from an extraction plant at Kenova, W. Va.

COLUMBIA-SOUTHERN CHEMICAL CORP. (subsidiary of Pittsburgh Plate Glass Co.), Barberton, Ohio.
Raw material: Propane.
Principal product: Perchloroethylene and carbon tetrachloride.

COLUMBIA - SOUTHERN CHEMICAL CORP. (subsidiary of Pittsburgh Plate Glass Co.), Natrium, W. Va.
Raw material: Benzene.
Principal products: Monochlorobenzene, ortho-dichlorobenzene, paradichlorobenzene, and benzene hexachloride.

COLUMBIA - SOUTHERN CHEMICAL CORP. (subsidiary of Pittsburgh Plate

Glass Co.), South Charleston, W. Va.
Raw material: Natural gas.
Principal product: Carbon bisulfide.

COMMERCIAL SOLVENTS CORP., Sterlington, La.
Raw material: Hydrogen and carbon monoxide.
Principal product: Methanol.
Raw material: Natural-gas fractions.
Principal products: Nitroethane, nitromethane, 1-nitropropane, 2-nitropropane, and nitrobutane.

CONTINENTAL OIL CO., Baltimore.
Raw material: Propylene tetramer and benzene.
Principal products: Alkyl aryl sulfonating stocks including dodecylbenzene.

CONTINENTAL OIL CO., Chicago.
Raw material: Dodecylbenzene.
Principal products: Water-soluble surface-active sulfonates including liquid, slurried, drum-dried, and spray-dried stocks (dodecylbenzenesulfonic acid type) and oil-well fracturing compounds.

CONTINENTAL OIL CO., Gretna, La.
Raw material: Lube-oil stocks.
Principal products: White mineral oils, petroleums, and natural sulfonates.

CONTINENTAL OIL CO., Lake Charles, La.
Raw material: Naphtha fraction.
Principal product: Benzene (300 bbl. per day) and toluene-xylenes mix (1,600 bbl. per day).
Raw material: Propylene.
Principal product: Propylene tetramer.

CONTINENTAL OIL CO., Ponca City, Okla.
Raw material: Naphtha fraction.
Principal products: Benzene (350 bbl. per day) and toluene-xylenes mix (1,200 bbl. per day).
Raw material: Propylene.
Principal product: Propylene tetramer.

CONTINENTAL OIL CO., Trainer, Pa.
Raw material: Alkyl aryl sulfonating feed stock.
Principal products: Oil-soluble surface-active sulfonates (lubricating-oil detergent additive and fuel-oil additives).

COSDEN PETROLEUM CORP., Big Spring, Tex.
Raw material: Naphtha fractions.
Principal products: Benzene (180 bbl. per day), toluene (550 bbl. per day), xylenes (800 bbl. per day), ortho-xylene (99% purity), meta-xylene (80% purity), ethylbenzene, styrene monomer (20,000,000 lb. per year), and polystyrene (22,000,000 lb. per year).
Raw material: Mixed olefins.
Principal product: Polybutene (2,400,000 gal. per year).

CROWN CENTRAL PETROLEUM CORP. Pasadena, Tex.
Raw material: Refinery gas stream.
Principal product: Propane-propylene stream (sold to Shell Chemical Corp.).

D

DELHI-TAYLOR OIL CORP., Corpus Christi, Tex.
Raw material: Selected petroleum fractions.
Principal products: Benzene (1,000 bbl. per day), toluene (800 bbl. per day), xylenes (700 bbl. per day), alphatic solvents, and heavy aromatic solvents. (Capacity of extraction unit is 5,000 bbl. per day.)

DIAMOND ALKALI CO., Bell, W. Va.
Principal product: Chlorinated methanes.

DIAMOND ALKALI CO., Painesville, Ohio.
Principal product: Chlorinated paraffins.

DIAMOND ALKALI CO., Deer Park Plant, Pasadena, Tex.
Raw material: Ethylene.
Principal products: Perchlorethylene, vinyl chloride monomer (50,000,000 lb. per year), and polyvinyl chloride. This plant also has new chlorine-caustic facilities.)
Construction: Considering a $10,000,000, 40-ton per day acetylene plant.

DIAMOND ALKALI CO., Greens Bayou Plant, Pasadena, Tex.
Raw material: Benzene.
Principal products: Benzene hexachloride and DDT.
Project: Production of C_{12} xylenes from p-xylenes on a semicommercial basis.

DOW BADISCHE CHEMICAL CO. (owned jointly by Dow Chemical Co. and Badische Anilin- and Soda-Fabrik, AG, Ludwigshafen, Germany), Freeport, Tex.
Construction: Facilities for manufacture of products derived from acetylene are scheduled for completion in December 1959, with production to start in January 1960. Products will include acrylic acids and methyl, ethyl, butyl and other acrylic esters.

DOW CHEMICAL CO., Allyn's Point, Conn.
Raw material: Styrene.
Principal product: Polystyrene.

DOW CHEMICAL CO., Bay City, Mich.
Principal products: Ethylene and butadiene (with polyethylene facilities scheduled for completion by the end of summer 1959).

DOW CHEMICAL CO., Freeport, Tex.
Raw material: Natural gas, liquefied petroleum gases, and benzene.
Principal products: Ethylene diamine; mono, di, tri, -ethanolamines; glycerin; ethylene and propylene oxides; ethylene, -propylene, -diethylene, -dipropylene, tetraethylene, -triethylene, -tripropylene glycols; carbon tetrachloride; chloroform; dichlorethyl, -dichloroisopropyl ether; styrene, ethyl benzene; ethyl, -methyl, -methylene chlorides; vinyl, -vinylidene chlorides; ethylene, -ethylidene, -propylene dichlorides; methyl chloroform; perchlorethylene; styrene-butadiene latex; polyethylene; trichloroethylene; allyl alcohol and allyl chloride.

DOW CHEMICAL CO., Ironton, Ohio.
Raw material: Styrene.
Principal product: Polystyrene.

DOW CHEMICAL CO., Midland, Mich.
Raw material: Crude oil, natural gas, and benzene.
Principal products: Ethylene; propylene; styrene; methyl styrene; ethylene glycol; ethyl benzene; ethyl chloride; ethylene dibromide; diethylbenzene; polystyrene; divinylbenzene; ethylene dichloride; ethylene oxide; mono-, di-, -tri ethanolamines; ethylene diamine; i-propylbenzene (cumene); i-propyl chloride; propylene oxide; propylene dichloride; i-propanolamines; toluene-2°; polyglycols; glycol ethers; styrene-butadiene latex; polyvinyl chloride; vinyl-toluene; and vinylidene chloride polymer.

DOW CHEMICAL CO., Pevely, Mo.
Raw material: Styrene.
Principal product: Polystyrene.

DOW CHEMICAL CO., Pittsburg, Calif.
Raw material: Natural gas, styrene, and butadiene.
Principal products: Methylene chloride, methyl chloride, chloroform, carbon tetrachloride, perchloroethylene, and styrene-butadiene latex.

DOW CHEMICAL CO., Plaquemine, La.
Raw material: Liquid petroleum gas.
Principal products: Ethylene, propylene, glycols, vinyl chloride, and other chlorinated hydrocarbons and related products.
Construction: Facilities to produce polyethylene will be completed in October 1960. Facilities to produce vinylidene chloride and methyl chloroform will be completed by May 1961.

DOW CHEMICAL CO., Torrance, Calif.
Raw material: Styrene.
Principal product: Polystyrene.

DOW CHEMICAL CO., Williamsburg, Va.
Principal product: Zefran acrylic fiber facilities (12,000,000 lb. per year).

DU PONT DE NEMOURS & CO., E. I., Antioch, Calif.
Raw material: Petroleum base stock.
Principal products: Tetraethyl lead and fluorinated hydrocarbons.

DU PONT DE NEMOURS & CO., E. I., Beaumont, Tex.
Raw material: Ethylene.
Principal products: Chlorosulfonated polyethylene synthetic rubber and menthionine.
Construction: Plans have been announced to build a 50,000,000 lb. per year caprolactam plant based on cyclohexane. Completion was reported scheduled by the end of 1960.

DU PONT DE NEMOURS & CO., E. I., Circleville, Ohio.
Raw material: Dimethyl terephthalate and ethylene glycol.
Principal product: Polyester film.

DU PONT DE NEMOURS & CO., E. I., Florence, S. C.
Construction: New plant under way to double capacity of Du Pont's polyester film. Completion is scheduled early in 1961.

DU PONT DE NEMOURS & CO., E. I., La Porte, Tex.
Raw material: Methanol.
Principal products: Carbamate fungicides, methylamines, and dimethyl formamide.

DU PONT DE NEMOURS & CO., E. I., Memphis, Tenn.

Raw material: Natural gas.
Principal products: Hydrogen cyanide, sodium cyanide, sodium, chlorine, and hydrogen peroxide.

DU PONT DE NEMOURS & CO., E. I., Orange, Tex.
Raw material: Natural gas, propane, benzene, cyclohexane, and adiponitrile.
Principal products: Methanol, polyethylene, nylon intermediates, adipic acid, hexamethylene-diamine. (Ethylene made from gas and/or propane is used internally.)
Construction: A new plant to produce linear polyethylene by a low-pressure process will be completed by mid-1960. Ethylene will be the raw material.

DU PONT DE NEMOURS & CO., E. I., Parkersburg, W. Va.
Principal product: Acetal resin.

DU PONT DE NEMOURS & CO., E. I., Victoria, Tex.
Raw material: Natural gas and butadiene.
Principal product: Adiponitrile (nylon salt basic).

DX SUNRAY OIL CO., Duncan, Okla.
Raw material: Refinery gases.
Principal product: Propylene tetramer.

E

EASTERN STATES PETROLEUM & CHEMICAL CORP., Houston, Tex.
Raw material: Refinery stream.
Principal products: Benzene (700 bbl. per day), toluene (1,100 bbl. per day), zylene (1,200 bbl.), hexane (200 bbl.), heptane (200 bbl.), aliphatic solvents (1,400 bbl.), and aromatic solvents (600 bbl.).

ESCAMBIA CHEMICAL CORP., Pensacola, Fla.
Raw material: Natural gas.
Principal products: Methanol (16,000,000 gal. per year) and polyvinyl chloride (30,000,000 lb. per year).

ESSO STANDARD OIL CO., Baton Rouge, La.
Raw material: Natural gas, refinery gas streams, and liquid fractions.
Principal products: Aromatic distillates and solvents (600 bbl. per day of benzene), aromatic tars, ethane, ethylene, propylene, isobutylene, isoprene, tripropylene, ethanol, isopropanol, isooctanol, decanol, tridecanol, ethyl ether, isopropy ether, dicyclopentadiene, benzene, tetrapropylene, petroleum resins, normal butylene, polyisobutylene, and hydrogen.
Construction: This year's building program includes modifications to the oxo plant to enable production of a broader range of oxo alcohols. Raw materials used will be liquid fractions and unsaturated gas.

ESSO STANDARD OIL CO., Bayonne, N. J.
Raw materials: Liquid fractions.
Principal products: Naphthenic acids and lubricating oil additives.
Construction: This year's program includes facilities to produce new multifunctional viscosity-index-improver pour-depressant lube-oil additives. In 1960 construction will include modernization of facilities to produce pour depressants and extreme-pressure additives.

ESSO STANDARD OIL CO., Linden, N. J.
Raw material: Refinery-gas streams and liquid fractions.
Principal products: Ethylene, isobutylene, polyisobutylenes, sec.-butanol, methyl ethyl retone, acetone, lube-oil additives, and tripropylene.

ETHYL CORP., Baton Rouge, La.
Raw material: Ethane and ethylene.
Principal products: Tetraethyl lead, ethyl chloride, ethylene dichloride, and vinyl chloride monomer.

ETHYL CORP., Pasadena, Tex.
Raw material: Ethylene.
Principal products: Tetraethyl lead, ethyl chloride, and ethylene dichloride.

ETHYL CORP., Pittsburg, Calif.
Principal product: Tetraethyl lead.

ETHYL-DOW CHEMICAL CO., INC., Freeport, Tex.
Raw material: Ethylene.
Principal product: Ethylene dibromide.

F

FIRESTONE PLASTIC CO., Division of Firestone Tire & Rubber Co., Pottstown, Pa.
Raw material: Petroleum-base stocks.
Principal products: Polybutadiene-acrylonitrile type (N-type) acrylic elastomers, polybutadiene-styrene type acrylic elastomers, and vinyl resins.

FOOD MACHINERY & CHEMICAL CORP., South Charleston, W. Va.
Raw material: Methane (natural gas).
Principal product: Carbon bisulfide.

FOOD MACHINERY & CHEMICAL CORP., Chemicals & Plastics Division, Nitro, W. Va.
Raw material: Petroleum cresylic acid.
Principal products: Tricresyl phosphate, plasticizers, and diisooctyl phthalate and diallyl phthalate monomer from isooctyl, allyl, and other alchols.

FOSTER GRANT CO., INC., Baton Rouge, La.
Raw material: Benzene and ethylene.
Principal product: Styrene (105,000,000 lb. per year).
Construction: To expand styrene capacity to 120,000,000 lb. per year in 1960.

FOSTER GRANT CO., INC., Leominster, Mass.
Raw material: Styrene monomer.
Principal products: Polystyrene (capacity increased to 15,000,000 lb. per year), styrene acrylonitrile molding powder (6,000,000 lb. per year), and molded articles (sunglasses).

FOSTER GRANT CO., INC., Manchester, N. H.
Raw material: Caprolactam.
Principal product: Nylon 6 molding powder.

FRONTIER OIL REFINING CO., Division of Ashland Oil & Refining Co., North Tonawanda, N. Y.
Raw material: Naphtha fraction.
Principal products: Benzene (300 bbl. per day) and toluene, xylenes, and heavy aromatics (1,000 bbl. per day).

G

GENERAL ANILINE & FILM, Linden, N. J.
Raw material: Ethylene.
Principal products: Ethylene oxide (60,000,000 lb. per year) and ethylene glycol (35,000,000 lb. per year).

GENERAL PETROLEUM CORP., Ferndale, Wash.
Raw material: Refinery streams.
Principal product: Sodium sulfide sludge.

GENERAL PETROLEUM CORP., Torrance, Calif.
Raw material: Refinery streams.
Principal products: Sodium cresylate sludge, hydrogen sulfide (in commercial amine solution), and crude naphthenic acids. (Crude naphthenic acids are processed into highly refined naphthenic acids and metallic naphthenates at the Vernon process products plant at Los Angeles.)

GENERAL TIRE & RUBBER CO., Ashtabula, Ohio.
Raw material: Acetylene.
Principal product: Polyvinyl chloride.

GENERAL TIRE & RUBBER CO., Mogadore, Ohio.
Raw material: Butadiene, styrene, and other petroleum-derived materials.
Principal products: Polybutadiene-styrene latices, vinyl pyridine type acrylic latices, and polyurethane elastomers.

GOODRICH CHEMICAL CO., B. F., Akron, Ohio.
Raw material: Petroleum-base stocks.
Principal products: Butadiene-acrylonitrile (N-type).

GOODRICH CHEMICAL CO., B. F., Avon Lake, Ohio.
Raw material: Alcohols and vinyl chloride.
Principal products: Plasticizers and polyvinyl chloride resins and compounds.

GOODRICH CHEMICAL CO., B. F., Louisville.
Raw material: Petroleum-base stocks.
Principal products: Special rubbers including acrylonitrile-butadiene, carboxylic nitrile, liquid SBR, butadiene-styrene, and polyacrylic rubber.

GOODYEAR TIRE & RUBBER CO., Chemical Division, Akron.
Raw material: Petroleum-base stocks.
Principal products: Butadiene acrylonitrile (N-type) elastomers (rubber and latices), high-styrene-type (paint bases, rubber reinforcers, molding resins), styrenated products, butadiene-styrene elastomers (rubbers and latices), and vinyl chloride polymers (resins and latices).
(Goodyear also makes vinyl chloride polymers, alkyl and aryl organic-rubber-processing chemicals, and butadiene-styrene and butadiene-acrylonitrile rubbers and resins at other plants.)

GOODYEAR TIRE & RUBBER CO., Point Pleasant, W. Va.
Principal product: Polyester resins.

GRACE CO., W. R., Dewey and Almy Division, Owensboro, Ky.
Principal products: Styrene-butadiene latices, polyvinyl acetate, and battery separators.

GRACE CO., W. R., Polymer Chemicals Division, Baton Rouge, La.
Raw material: Ethylene.
Principal product: Polyethylene.

GREAT SOUTHERN CHEMICAL CORP. (Pontiac Refining Corp., La Gloria Oil & Gas Corp., and Gulf Oil Corp.), Corpus Christi, Tex.
Raw material: Naphtha fractions.

Principal products: Benzene, toluene, and xylenes.

GREAT WESTERN PRODUCERS, INC., Irving, Tex.
Raw material: Distillate and crude oil.
Principal products: Aromatic solvents, aliphatic solvents, gasolines, and diesel fuel.

GULF OIL CORP., Philadelphia.
Raw materials: Refinery gases.
Principal products: Propylene and sulfur.
Construction: Installation of new plant for production of 35,000,000 to 40,000,000 lb. of oxo alcohols scheduled mid-1959, with completion early in 1961. Additional facilities to produce oxo derivatives to follow.

GULF OIL CORP., Port Arthur, Tex.
Raw materials: Refinery gases, refinery streams, heptenes, propane, and butane.
Principal products: Ethylene, propylene, butylenes, isooctyl alcohol, propylene trimer, propylene tetramer, octyl polymer, aromatic distillate, benzene (30,000,000 gal. per year), and toluene.

H

HERCULES POWDER CO., Burlington, N. J.
Raw material: Para-xylene methanol.
Principal product: Dimethylterephthalate (12,000,000 lb. per year).

HERCULES POWDER CO., Gibbstown, N. J.
Raw material: Propylene and benzene.
Principal products: Phenol, acetone, cumene, cumene hydroperoxide, acetophenone, and a-methylstyrene.

HERCULES POWDER CO., Louisiana, Mo.
Raw material: Natural gas.
Principal products: Methanol (70 tons per day), formaldehyde (100,000,000 lb. per year), and pentaerythritol (24,000,000 lb. per year).

HERCULES POWDER CO., Parlin, N. J.
Raw material: Ethylene.
Principal product: Polyethylene (Ziegler process, 30,000,000 lb. per year).
Raw material: Propylene.
Principal product: Polypropylene (20,000,000 lb. per year).

HEYDEN CHEMICAL CORP., Texas City, Tex.
(Part owner with Monsanto Chemical Co. in methanol plant. See Monsanto, Texas City, Tex., listing).

HOOKER CHEMICAL CORP., Eastern Chemical Division, Niagara Falls, N. Y.
Raw material: Pentane and petroleum waxes.
Principal products: Chlorinated waxes, hexachlorocyclopentadiene, isophthaloyl chloride, and terephthaloyl chloride.

HUMBLE OIL & REFINING CO., Baytown, Tex.
Raw material: Refinery streams.
Principal products: Benzene (2,500 bbl. per day), toluene (5,000 bbl. per day), solvent xylene (5,500 bbl. per day), Paraxylene (600 bbl. per day), orthoxylene, high-boiling-range aromatic solvents, ethylene, propylene concentrate, normal butylenes, isobutylene, pentylene concentrate, tripropylene, tetrapropylene, narrow-boiling-range aliphatic naphthas (hexane, heptane, and octane), cyclohexane, special naphthas, aromatic quench oil, and carbon-black feed stock.
Construction: New facilities for production of 40,000,000 lb. per year of polypropylene scheduled for completion in January 1960.

I

INDEX CHEMICAL CO. (subsidiary of Pennsalt Chemicals Corp.), Houston.
Raw materials: Natural gas, butane, methyl alcohol, ethyl alcohol, sulfur, and various olefins.
Principal products: Methyl mercaptan, ethyl mercaptan, thiophene butyl mercaptan, tetrahydrothiophene, octyl mercaptan, tertiary butyl mercaptan, tertiary nonyl mercaptan, and tertiary dodecyl mercaptan.

J

JEFFERSON CHEMICAL CO., INC., Port Neches, Tex.
Raw material: Refinery gases (ethane, propane streams) and other raw materials.
Principal products: Ethylene (180,000,000 lb. per year), ethylene oxide (165,000,000 lb. per year), ethylene glycol (126,000,000 lb. per year), ethylene chloride, chlorine, propylene oxide, propylene and dipropylene glycol, piperazine, ethylene oxide-tridecyl alcohol condensates, diethylene and triethylene glycols, polyethylene glycols, ethanolamines, ethylene carbonate, propylene carbonate, morpholine, nonyl phenol, and ethylene oxide-nonyl phenol condensates.

JEFFERSON LAKE SULPHUR CO., Merichem Division, Houston.
Raw material: Refinery treating wastes.
Principal products: Phenol, cresols, cresylic acid (200,000 gal. per month), and sodium sulfide.

K

KENDALL REFINING CO., Bradford, Pa.
Raw material: Petroleum fractions.
Principal products: Heavy hydrocarbons (petroleum polymer and condensation resins).

KOPPERS CO., INC., Plastic Division, Kobuta, Pa.
Raw material: Ethylbenzene.
Principal products: Styrene and expandable polystyrene beads.

KOPPERS CO., INC., Plastic Division, Port Arthur, Tex.
Raw material: Ethylene.
Principal products: Ethylbenzene and polyethylene.
Construction: Plans to double polyethylene capacity are still under consideration.

KOPPERS CO., INC., Plastic Division, Woodridge Township, N. J.
Raw material: Ethylene (from Esso Bayway plant via pipeline).
Principal product: Polyethylene—Ziegler process (30,000,000 lb. per year).

L

LEONARD REFINERIES, INC., Roosevelt Division, Mount Pleasant, Mich.
Raw material: Naphtha fraction.
Principal products: Benzene (250 bbl. per day), toluene (250 bbl. per day), and xylene concentrates (30 bbl. per day).

LUBRIZOL CORP, Cleveland.
Raw material: Petroleum fractions.
Principal product: Lube-oil additives.

LUBRIZOL CORP., Pasadena, Tex.
Raw material: Petroleum fractions.
Principal product: Lube-oil additives.

M

MAGNOLIA PETROLEUM CO., Beaumont, Tex.
Raw material: Petroleum fractions.
Principal products: Cresylic acid and sodium cresylate solutions.
Construction: Magnolia will build new facilities for production of 380,000,000 lb. per year of ethylene, 100,000,000 lb. per year of propylene, and 20,000,000 lb. per year of butadiene. Completion is scheduled first quarter of 1961. Cost of project will be $25 million.

MARBON CHEMICAL, Division of Borg-Warner Corp., Gary, Ind. (two plants).
Raw material: Acrylonitrile, butadiene, and styrene.
Principal products: High-styrene resins and high-impact thermoplastic molding material.

MARBON CHEMICAL, Division of Borg-Warner Corp., Parkersburg, W. Va.
Raw material: Styrene, acrylonitrile, and butadiene.
Principal products: High-impact thermoplastic resins.

MOBIL OIL CO., Augusta, Kans.
Raw material: Petroleum fractions.
Principal products: Select aromatic oils.

MOBIL OIL CO., Brooklyn, N. Y.
Raw material: Petroleum fractions.
Principal products: Sodium cresylate solutions.

MOBIL OIL CO., Buffalo.
Raw material: Petroleum fractions.
Principal products: Sodium sulfide solutions and sodium cresylate solutions.

MOBIL OIL CO., Casper, Wyo.
Raw material: Petroleum fractions.
Principal product: Select aromatic oils.

MOBIL OIL CO., East Chicago, Ind.
Raw material: Refinery streams.
Principal products: Sodium cresylate solutions and hydrogen.

MOBIL OIL CO., East St. Louis, Ill.
Raw material: Refinery streams.
Principal products: Sodium cresylate solutions.

MOBIL OIL CO., Paulsboro, N. J.
Raw material: Petroleum fractions.
Principal products: Sodium cresylate solutions, sodium sulfide solutions, and propylene.

MONSANTO CHEMICAL CO., Lion Oil Co. Division, El Dorado, Ark.
Construction: Propylene tetramer unit at the El Dorado refinery is scheduled for completion in 1959.

MONSANTO CHEMICAL CO., Lion Oil Co. Division, Texas City, Tex.
Raw material: Natural gas, propane, butane, and benzene.
Principal products: Ethylene and propylene.

MONSANTO CHEMICAL CO., Organic Chemicals Division, Avon, Calif.
Raw material: Benzene.
Principal product: Phenol (by sulfonation).

MONSANTO CHEMICAL CO., Organic Chemicals Division, Luling, La.
Raw material: Petroleum-derived fractions.
Principal product: Adipic acid.

MONSANTO CHEMICAL CO., Plastics Division, Texas City, Tex.
Raw material: Natural gas, propane, and benzene.
Principal products: Ethylbenzene, styrene monomer (360,000,000 lb. per year), ethylene dichloride, vinyl chloride, acrylonitrile (100,000,000 lb. per year), hydrogen cyanide, toluene-2°, tertiary-butylamine. (Acetylene and ethylene made at Texas City are used internally).
Raw material: Ethylene.
Principal product: Polyethylene.
Construction: Polyethylene capacity will be expanded to 100,000,000 lb. per year by the end of 1959.

MONSANTO CHEMICAL CO. and **HEYDEN CHEMICAL CORP.**, Texas City, Tex.
Raw material: Byproduct hydrogen and carbon monoxide from acetylene synthesis.
Principal product: Methanol.

MONTROSE CHEMICAL CO., Newark, N. J.
Raw material: Petroleum cresylic acid.
Principal products: Tricresyl phosphate and diphenyl monocresyl prosphate.

N

NATURAL GAS ODORIZING, INC., Houston.
Raw material: Crude mercaptans (ethyl and higher).
Principal product: Odorants for natural gas and LPG.

NAUGATUCK CHEMICAL, Division of U. S. Rubber Co., Baton Rouge, La.
Raw material: Styrene, butadiene, and acrylonitrile.
Principal products: N-type rubber, styrene copolymers and latices, as ABS polymers.

NAUGATUCK CHEMICAL, Division of U. S. Rubber Co., Naugatuck, Conn.
Raw material: Styrene and butadiene.
Principal product: Butadiene-styrene copolymers.

NEVILLE CHEMICAL CO., Anaheim, Calif.
Raw material: Unsaturated petroleum fractions.
Principal products: Aromatic petroleum solvents, heat-reactive resins, and thermoplastic resins.

NEVILLE CHEMICAL CO., Neville Island, Pa.
Raw material: Unsaturated petroleum fractions.
Principal products: Aromatic petroleum solvents, heat-reactive resins, and thermoplastic resins.

NOPCO CHEMICAL CO., Griffin Chemical Division, Richmond, Calif.
Raw material: Petroleum fractions.
Principal products: Naphthenic acid and petroleum sulfonates (emulsifying agents).

NOVAMONT CORP. (subsidiary of Montecatini), Neal, W. Va.
Construction: A $10-million plant, with capacity of 10,000,000 lb. annually of polypropylene and other polyolefins, is due for completion within 2 years.

O

ODESSA STYRENE CO. (El Paso Natural Gas Products Co. and United Carbon Co.), Odessa, Tex.
Raw material: Propane and benzene.
Principal product: Styrene (40,000,000 lb. per year).

OLIN-MATHIESON CHEMICAL CORP., Brandenburg, Ky.
Raw material: Natural-gas liquids (ethane).
Principal products: Ethylene oxide, ethylene, diethylene and triethylene glycols, polyethylene glycols, ethylene dichloride, ethylene diamine, ethylene glycol ethers, ethanolamines, dichloroethyl ether, aromatic distillates and solvents, ethylene glycol ether esters, ethylene chlorohydrin, nonionic surface active agents (aliphatic polyoxyethylene ether alcohols), pour-point depressant and v.i. improver for lube oil.

ORONITE CHEMICAL CO. (subsidiary of Standard Oil Co. of California), Oak Point, La.
Raw material: Petroleum base stocks.
Principal products: Lube-oil additives, furnace-oil additive, gas odorants, nonionic detergents, algicides, alkyl phenols, grease additive, and diesel-fuel additive.

P

PENNSALT CHEMICALS CORP., Wyandotte, Mich.
Raw material: Pentane, pentane fractions, and triisobutylene.
Principal products: Amyl alcohol, amyl chloride, amyl acetate, amyl phenols, amyl naphthalenes, n-alkyl mercaptans, tertiary dodecyl mercaptan, polyethylene glycol tert-dodecyl thioether, 2-pentene, mixed pentenes, thiophene, tetene, tetra hydrothiophene, and carbon disulfide.

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP., Chester, Pa.
Raw material: Petroleum base stocks.
Principal products: Petroleum polymer and condensation resins.

PENNSYLVANIA INDUSTRIAL CHEMICAL CORP., West Elizabeth, Pa.
Principal products: Hydrocarbon resins and aromatics.

PENNSYLVANIA REFINING CO., Karns City, Pa.
Raw material: Finished and semifinished lube oil and distillates.
Principal products: Petroleum sulfonates.

PETROCHEMICALS CO., Long Beach, Calif.
Raw material: Petroleum fractions.
Principal products: Alkyl naphthalene sulfonates, aromatic solvents, and alkyl naphthalene sulfonate with insignificant foam.

PETROCHEM CHEMICALS, INC. (Cities Service Co. and Continental Oil Co.), Lake Charles, La.
Raw material: Petroleum feed stocks.
Principal products: Ethylene (200,000,000 lb. per year, expandable to 300,000,000 lb.); propylene (40,000,000 lb. per year); and aromatic distillate (500,000 lb. per year).

PETRO-TEX CHEMICAL CORP., Houston.
Raw material: Petroleum base stock.
Principal products: Butene-1, butene-2, diisobutylene, triisobutylene, isobutylene (2,000,000 gal. per year), and aviation alkylate.

PHILLIPS CHEMICAL CO. (operated by Cosden Petroleum Corp.), Big Spring, Tex.
Raw material: Mixed xylenes.
Principal product: Para xylene (5,300,000 lb. per year).

PHILLIPS CHEMICAL CO., Pasadena, Tex.
Raw material: Methylethylpyridine.
Principal product: Methylvinylpyridine (3,700,000 lb. per year).
Raw material: Ethylene.
Principal product: Polyethylene (75,000,000 lb. per year).
Construction: Methylvinylpyridine capacity is being expanded to 5,400,000 lb. per year.

PHILLIPS CHEMICAL CO., Phillips, Tex.
Raw material: Petroleum fractions.
Principal products: Tert-butyl mercaptan, tert-dodecyl mercaptan, other sulfur chemicals, n-butyl mercaptan, other chemical specialties, n-propyl mercaptan, and high-purity hydrocarbons.

PHILLIPS CHEMICAL CO. (operated by Phillips Petroleum Co.), Sweeny, Tex.
Raw material: Butane and/or propane.
Principal products: Ethylene (180,000,000 lb. per year) and propylene.
Construction: Ethylene capacity is being expanded to 255,000,000 lb. per year.

PHILLIPS PETROLEUM CO., Kansas City, Kans.
Raw material: Petroleum fractions.
Principal products: Rubber extender, process oils, and n-pentane.

PHILLIPS PETROLEUM CO., Phillips, Tex.
Raw material: Petroleum fractions.
Principal products: Diisopropyl, cyclohexane, hydrogen sulfide, and ethyl mercaptan.

PHILLIPS PETROLEUM CO., Sweeny, Tex.
Raw material: Petroleum fractions.
Principal product: Cyclohexane.

PROCESSORS, INC., and **OIL & CHEMICAL PRODUCTS, INC.**, Galena Park, Tex.
Raw material: Petroleum fractions.
Principal products: Benzene, toluene, xylenes, aromatic solvent naphthas, and DDT base.

PRODUCTOL CO., Santa Fe Springs, Calif.
Raw material: Refinery byproduct fractions.
Principal products: Phenols, cresols, and cresylic acids.

PURE OIL CO., Smiths Bluff, Tex.
Raw material: Petroleum fractions and refinery-gas streams.
Principal products: Petroleum polymer, condensation resins, solvents, nonparaf-

fin concentrates, 1-butene, 2-butene, and mixtures.

PURE OIL CO., Toledo.
Raw material: Petroleum fractions.
Principal products: Solvents, toluene-2° (620 bbl. per day), xylene (aviation grade), heavy mixed aromatics, and polymers. (Capacity of mixed xylenes is 1,260 bbl. per day.)

R

REICHHOLD CHEMICALS, INC., Azusa, Calif.
Raw materials: Formaldehyde, USP phenol, petroleum solvents, and styrene.
Principal products: Phenol-formaldehyde resins, alkyd resin solutions, and polyester resins.

REICHHOLD CHEMICALS, INC., Ballardvale, Mass.
Raw materials: Formaldehyde, USP phenol, methanol (from natural gas), bis-phenol, acetone, and epichlorhydrin.
Principal products: Phenol-formaldehyde resins, urea-formaldehyde resins, formaldehyde, and epoxy resins (10,000,000 lb. per year of liquid and solid epoxies).

REICHHOLD CHEMICALS, INC., Charlotte, N. C.
Raw materials: Methanol (from natural gas), formaldehyde, and vinyl acetate monomer.
Principal products: Formaldehyde, urea-formaldehyde resins, and polyvinyl acetate emulsions.

REICHHOLD CHEMICALS, INC., Detroit.
Raw materials: Formaldehyde, USP phenol, styrene, petroleum solvents, glycerin (synthetic), and normal butyl alcohol.
Principal products: Phenol-formaldehyde resins, urea-formaldehyde resins, polyester resins, styrenated alkyd resins, alkyd resin solutions, alkyd resins, and butylated urea-formaldehyde resins.

REICHHOLD CHEMICALS, INC., Elizabeth, N. J.
Raw materials: Benzene, formaldehyde, USP phenol, styrene, vinyl acetate monomer, and glycerin (synthetic).
Principal products: Maleic anhydride, phenol-formaldehyde resins, urea-formaldehyde resins, polyester resins, styrenated alkyd resins, polyvinyl acetate emulsions, alkyd resins, and ester gum.
Construction: Scheduled for completion in August 1960 is a $5,000,000 maleic anhydride plant with capacity of 20,000,000 lb. per year. Raw material will be benzene.

REICHHOLD CHEMICALS, INC., Hampton, S. C.
Raw material: Methanol (from natural gas).
Principal product: Formaldehyde.

REICHHOLD CHEMICALS, INC., Houston.
Raw material: Styrene and petroleum solvents.
Principal products: Polyester resins and alkyd resins.

REICHHOLD CHEMICALS, INC., Jacksonville, Fla.
Raw material: Formaldehyde.
Principal product: Urea-formaldehyde resins.

REICHHOLD CHEMICALS, INC., Kansas City, Kans.
Raw materials: Formaldehyde, USP phenol, vinyl acetate monomer, and methanol (from natural gas).
Principal products: Phenol-formaldehyde resins, polyvinyl acetate emulsions, and formaldehyde.

REICHHOLD CHEMICALS, INC., Seattle.
Raw materials: USP phenol, formaldehyde, and methanol (from natural gas).
Principal products: Pentachlorophenol, phenol-formaldehyde resins, and formaldehyde.

REICHHOLD CHEMICALS, INC., South San Francisco, Calif.
Raw materials: Formaldehyde, USP phenol, petroleum solvents, and vinyl acetate monomer.
Principal products: Phenol-formaldehyde resins, urea-formaldehyde resins, alkyd resin solutions, and polyvinyl acetate emulsions.

REICHHOLD CHEMICALS, INC., Tacoma, Wash.
Raw materials: Methanol (from natural gas), formaldehyde, and USP phenol.
Principal products: Formaldehyde, phenol-formaldehyde resins, and pentachlorophenol.

REICHHOLD CHEMICALS, INC., Tuscaloosa, Ala.
Raw materials: Methanol (from natural gas), benzene, formaldehyde, acetaldehyde, USP phenol, and petroleum solvents.
Principal products: Formaldehyde, USP phenol, pentaerythritol, phenol-formaldehyde resins, and urea-formaldehyde resins.
Construction: Formaldehyde capacity will be doubled. A $1,500,000 program is under way to expand production of phenol from benzene, with completion scheduled in 1959. Another $1,500,000 program is under way to expand production of pentaerythritol from formaldehyde and acetaldehyde.

REPUBLIC OIL & REFINING CO., Division of Plymouth Oil Co., Texas City, Tex.
Raw material: Refinery-gas streams.
Principal products: Butane and butylenes, ethylene, propylene tetramer, and propylene trimer.

RICHFIELD OIL CORP., Wilmington, Calif.
Raw material: Petroleum fractions.
Principal products: Naphthenic acids.
Raw material: Refinery cracked gases.
Principal product: Ethylene-ethane stream.
Raw material: C_6 and C_7 naphthenes (selected straightrun gasoline fraction).
Principal products: Benzene (18,000,000 gal. per year), toluene (18,000,000 gal. per year), and mixed xylenes (335 bbl. per day).
Raw material: Propylene polymer.
Principal product: Propylene tetramer.

ROHM & HAAS CO., Pasadena (Deer Park), Tex.
Raw material: Natural gas.
Principal products: Methanol, ammonia, acetylene, carbon monoxide, and hydrogen.
Raw material: Hydrogen cyanide and acetone.
Principal product: Acetone cyanohydrin.
Raw material: Methanol and acetone cyanohydrin.
Principal product: Methyl methacrylate.
Raw material: Acetylene and carbon monoxide (methanol and ethanol).
Principal products: Methyl and ethyl acrylate.

SHELL CHEMICAL CORP., Denver.
Raw material: Petroleum hydrocarbons.
Principal products: Aldrin, dieldrin, endrin, methyl parathion, insecticide, and soil fumigant.

SHELL CHEMICAL CORP., Dominguez, Calif.
Raw material: Petroleum hydrocarbons.
Principal products: Isopropyl alcohol, acetone, methyl ethyl ketone, methyl isobutyl ketone, diacetone alcohol, sec.-butyl alcohol, mesityl oxide, and methyl isobutyl carbinol.

SHELL CHEMICAL CORP., Houston.
Raw material: Petroleum hydrocarbons (propylene, ethylene, and butylenes).
Principal products: Acetone, diacetone alcohol, ethyl alcohol, hexylene glycol, isopropyl alcohol, isopropyl ether, mesityl oxide, methyl ethyl ketone, methyl isobutyl carbinol, methyl isobutyl ketone, sec.-butyl alcohol, allyl alcohol, allyl chloride, epichlorohydrin, ethyl chloride, glycerin, epoxy resins, D-D soil fumigant, trichloropropane, bis-phenol-A, and acetone.

SHELL CHEMICAL CORP., Martinez, Calif.
Raw material: Petroleum hydrocarbons.
Principal products: Isopropyl alcohol, acetone, methyl ethyl ketone, methyl isobutyl ketone, ethyl amyl ketone, sec.-butyl alcohol, tert-butyl alcohol, trisubstituted phenol (2,6-ditertiary-butyl-4-methyl-phenol—used as antioxidant, p-tert-butyl benzoic acid, ditertiary butyl peroxide, and mono, di and triallylamines.

SHELL CHEMICAL CORP., New Jersey.
Construction: A 180-acre tract has been purchased from Swarthmore College across the Delaware River from Philadelphia. The company plans to build a synthetic resins and plastic plant at the site.

SHELL CHEMICAL CORP., Norco, La.
Raw material: Petroleum hydrocarbons.
Principal products: Crude chlorohydrin, allyl chloride, D-D soil fumigant, hydrogen peroxide, and sec.-butyl alcohol.
Construction: Will complete late 1959, facilities to make acrolein and 35,000,000 lb. per year of glycerin at a cost of more than $10,000,000.

SHELL OIL CO., Houston.
Raw material: Naphtha fractions.
Principal products: Benzene-1° (1,000 bbl. per day) and toluene-1° (2,200 bbl. per day).

SHELL OIL CO., Martinez, Calif.
Raw material: Refinery streams.
Principal products: Petroleum sulfonates (sodium salt).

SHELL OIL CO., Wilmington, Calif.
Raw material: Refinery streams.
Principal products: Xylene-3° (800 bbl. per day—blocked operation), cyclo-

hexane, toluene (900 bbl. per day—blocked operations), and cresylic acid.

SHELL OIL CO., Wood River, Ill.
Raw material: Naphtha fractions.
Principal products: Toluene (1,200 bbl. per day—blocked operation) and xylenes (1,400 bbl. per day—blocked operation).

SINCLAIR PETROCHEMICALS, INC., Corpus Christi, Tex.
Raw material: Petroleum fractions.
Principal products: Aromatic solvents.

SINCLAIR PETROCHEMICALS, INC., East Chicago, Ind.
Raw material: Petroleum fractions.
Principal products: Antioxidants, aromatic solvents, gear-oil additives, turbine-oil additives, cutting-oil additives, and cresylic acids.

SINCLAIR PETROCHEMICALS, INC., Hartford, Ill.
Raw material: Petroleum fractions.
Principal products: Aromatic solvents.

SINCLAIR PETROCHEMICALS, INC., Houston.
Raw material: Petroleum fractions.
Principal products: Oil-layer-type petroleum sulfonates (barium, calcium, and sodium salts), corrosion inhibitors, isoparaffinic odorless solvents, cresylic acids, and toluene and xylenes (60,000,000 gal. per year).

SINCLAIR PETROCHEMICALS, INC., Marcus Hook, Pa.
Raw material: Petroleum streams.
Principal products: Cresylic acids.
Raw material: Catalytic reformate.
Principal products: Toluene (400 bbl. per day), paraxylene (12,000,000 lb. per year), xylene solvents (1,000 bbl. per day), and heavy aromatic solvents.
Raw material: Refinery gas.
Principal product: High-purity propylene.
Raw material: Petroleum fractions.

SINCLAIR PETROCHEMICALS, INC., Sand Springs, Okla.
Raw material: Petroleum fractions.
Principal products: Demulsifying agents, corrosion inhibitors, acid-layer-type petroleum sulfonate (sodium salt), and oil-layer-type petroleum sulfonate (sodium salt).

SOHIO CHEMICAL CO., Lima, Ohio.
Construction: New plant to manufacture acrylonitrile is scheduled for completion in 1960.

SONNEBORN SONS, INC., L., Daugherty Refinery, Petrolia, Pa.
Raw material: Petroleum fractions.
Principal products: Oil-layer type of petroleum sulfonate (sodium and alkaline earth salts), and water-soluble petroleum sulfonate.

SPENCER CHEMICAL CO., Calumet City, Ill.
Raw material: Methanol and ammonia.
Principal product: Formaldehyde.

SPENCER CHEMICAL CO., Henderson, Ky.
Raw material: Caprolactum.
Principal product: Nylon-6 molding resins.

SPENCER CHEMICAL CO., Orange, Tex.
Raw material: Ethylene.
Principal product: Polyethylene (90,000,000 lb. per year).
Construction: Expansion of this polyethylene plant is under way, with completion set for summer 1960.

SPENCER CHEMICAL CO., Pittsburg, Kans.
Raw material: Natural gas.
Principal product: Methanol.

STANDARD OIL CO. OF CALIFORNIA, El Segundo, Calif.
Raw material: Petroleum base stocks.
Principal products: Benzene (1,500 bbl. per day), toluene, paraxylene, cumene, and butadiene-butylene mixtures.

STANDARD OIL CO. OF CALIFORNIA, Richmond, Calif.
Raw material: Petroleum base stocks and natural gas.
Principal products: Orthoxylene, metaxylene, paraxylene, industrial xylenes, alkyl aromatic detergents in various forms, metallic naphthenates, naphthenic acids, cresylic acids, petroleum sulfonates, polybutenes, gas odorants, ethyl mercaptans, isophthalic acid, phthalic anhydride, phenol, acetone, benzoic-toluic acid, and terephthalic acid.

STANDARD OIL CO. (IND.), Sugar Creek, Mo.
Raw material: Petroleum fractions.
Principal products: Heptene concentrate and sodium cresylate.

STANDARD OIL CO. (IND.), Whiting, Ind.
Raw material: Petroleum fractions.
Principal products: Benzene-1°, nitration-grade toluene, xylenes-10°, acid-layer-type petroleum sulfonate, sodium cresylate, and petroleum base plasticizers.

STANDARD OIL CO. (IND.), Wood River, Ill.
Raw material: Heptene and nonene from olefin feed.
Principal products: Isooctyl and decyl or higher alcohols.
Raw material: Petroleum fractions.
Principal products: Polybutene and high-molecular-weight hydrocarbons, lube-oil detergent and corrosion inhibitor additives, gasoline and distillate-fuel additives, and sodium cresylate.

STAUFFER CHEMICAL CO., Le Moyne, Ala.
Raw material: Natural gas.
Principal product: Carbon disulfide.

STAUFFER CHEMICAL CO., Louisville, Ky.
Raw material: Propane, propylene, and natural gas.
Principal products: Carbon tetrachloride, perchlorethylene, chloroform, methylene chloride, and hydrogen chloride.

SUN OIL CO., Marcus Hook, Pa.
Raw material: Refinery streams.
Principal products: Petroleum sulfonates, naphthenic acids, propylene tetramer (dodecene), propylene trimer (nonene), benzene (1,360 bbl. per day), toluene (2,150 bbl. per day), and xylene (1,290 bbl. per day mixed xylenes).
Construction: Work has started on a new $2-million propylene plant, which will be capable of producing 120,000,000 lb. annually when completed late in 1959. One customer will be AviSun Corp. at New Castle, Del., which will convert the propylene to polypropylene film.

SUN OIL CO., Toledo.
Raw material: Refinery streams.
Principal products: Butylenes propylene, and hydrogen.

SUNTIDE REFINING CO., Corpus Christi, Tex.
Raw material: Propylene.
Principal product: Tetramer (150,000 bbl. per year).
Raw material: Naphtha.
Principal products: Benzene (420 bbl. per day), toluene (1,200 bbl. per day), m-xylene and p-xylene mixture—2% max. o-xylene (870 bbl. per day), o-xylene—90% min. o-xylene (260 bbl. per day), and heavy aromatic solvent (140 bbl. per day).

T

TENNESSEE EASTMAN CO., Division of Eastman Kodak Co., Kingsport, Tenn.
Raw material: Ethanol, isobutyraldehyde, normal-butyraldehyde, isobutyl alcohol, 2-ethylhexyl alcohol, 2-ethyl isohexanol, polyethylene, neopentyl glycol, isopropyl alcohol, and propionaldehyde.
Principal products: Acetic and butyric acids and anhydrides, acetaldehyde, acetanilide, n-butyl acetate, crotonic acid, dibutyl phthalate, diethyl phthalate, di-2-ethylhexyl phthalate, di-2-ethylhexyl adipate, diisobutyl adipate, di-2-ethylhexyl sebacate, diisobutyl phthalate, ethyl acetate, isobutyl acetate, isopropyl acetate, triethyl phosphate, acetone, polymeric plasticizer, 2-ethylhexoic acid, polyethylene color concentrates, polyethylene waxes, propionic acid, propionic anhydride, isobutyric acid, and isobutyric anhydride.
Raw material: Acetic and butyric acids and anhydrides.
Principal products: Cellulose acetate and cellulose acetate butyrate.
Raw material: Cellulose esters.
Principal products: Cellulose acetate textile fibers, acetate and butyrate plastics, plasticizers, modified acrylic fiber, and polyester fiber.

TEXAS BUTADIENE & CHEMICAL CORP., Channelview, Tex.
Raw material: N-butane, isobutane, isopentane, and natural gasoline.
Principal products: Alkylate, butene-2 concentrate, butene-1 concentrate, propylene concentrate, butadiene, and solvents.
Construction: Will complete facilities for propylene concentrate in September 1959. (This company has also obtained license from Cosden Petroleum Corp. for polybutene process.)

TEXACO INC., Port Arthur, Tex.
Raw material: Refinery fractions.
Principal products: Naphthenic acid, oil-layer type of petroleum sulfonates, ethane-ethylene stream, propane-propylene mixture, 1-butene, 2-butene and mixtures, heavy hydrocarbons, olefin polymers, diisobutylene, rust inhibitors, gasoline additives, and lubricating-oil additives.

TEXAS EASTMAN CO., Division of Eastman Kodak Co., Longview, Tex.
Raw material: Propane and natural gas.

Principal products: Ethanol, isobutyraldehyde, normal-butyraldehyde, isobutyl alcohol, isobutyronitrile, polyethylene (100,000,000 lb. per year), 2-ethylhexyl alcohol, 2-ethyl isohexanol, neopentyl glycol, and propionaldehyde. (Aldehydes capacity is 125,000,000 lb. per year.)

TIDEWATER OIL CO., Avon (Associated), Calif.
Raw material: Naphtha fraction.
Principal products: Mixed aromatics (1,-200 bbl. per day).

TIDEWATER OIL CO., Delaware City, Del.
Raw material: Naphtha fraction.
Principal products: Mixed aromatics (400 bbl. per day).

U

UNION CARBIDE CARIBE (unit of Union Carbide Corp.), Ponce, Puerto Rico.
Principal product: Ethylene oxide-glycol.

UNION CARBIDE CHEMICALS CO., Institute, W. Va.
Raw material: Natural gas and other petroleum streams.
Principal products: Acetaldehyde, acetic acid, acetic anhydride, acetone, acetonitrile, acetophenone, acrolein, acrylonitrile, n-butyl alcohol, butyric acid, butyric anhydride, diethylene glycol, diisobutyl ketone, 2-ethylbutanol, ethylene glycol, ethylene oxide, 2-ethylhexanol, n-hexanol, isophorone, isopropanol, maleic anhydride, mesityl oxide, methyl acetone, 2-methyl-5-ethyl pyridine, methyl isobutyl ketone, paraldehyde, plasticizers, alpha-picoline, gamma-picoline, polyethylene glycols, propionic anhydride and trimethyl nonanone-4.

UNION CARBIDE CHEMICALS CO., Niagara Falls, N. Y.
Raw material: Acetylene.
Principal products: Vinyl esters and acetic acid hydroxyethyl cellulose.

UNION CARBIDE CHEMICALS CO., Putnam, W. Va.
Construction: Plans have been delayed indefinitely for a plant which was initially slated for completion in 1960. Estimates indicate a construction delay of 2 or 3 years.

UNION CARBIDE CHEMICALS CO., Seadrift, Tex.
Raw material: Natural gas (ethane).
Principal products: Polyethylene, ethylene oxide, and ethylene glycol.

UNION CARBIDE CHEMICALS CO., South Charleston, W. Va.
Raw material: Natural gas, refinery gases, crude oil, and other petroleum fractions.
Principal products: Alcohols; esters; ketones; glycol-ethers; plasticizers such as dioctyl phthalate and others; glycols such as ethylene-, di-and-triethylene glycols and others; polyethylene plastic; synthetic lubricants; oxides (ethylene and propylene oxides and acetals; aldehydes; organic acids; anhydrides; nitrogen compounds such as acetonitrile, amines (mono, di, and triethanol amines, morpholine and other amines); chlorine compounds such as ethylene dichloride, ethylene and propylene chlorhydrin, etc.; aryl chemicals such as acetoacetanilide, 2-methyl-5-ethyl pyridine, etc.; and surface-active agents (ionics and anionics).

UNION CARBIDE CHEMICALS CO., Texas City, Tex.
Raw material: Natural gas and refinery gases (ethane, propane).
Principal products: Acetaldehyde, acetic acid, acetic anhydride, acetone, 2-aminoethyl ethanolamine, n-butyl acetate, n-butyl alcohol, diethylene glycol, diethylene triamine, ethanol, ethyl acetate, ethylene diamine, ethylene dichloride, ethylene glycol, ethylene oxide, isobutanol, isopropanol, isopropyl, acetate, methanol, methyl acetone, methyl-isobutyl ketone, polyethylene, tetraethylene pentamine, trichlorethane, triethylene tetramine, vinyl acetate, vinyl chloride, and other vinyl resins and vinyl plastic materials. (Acetylene made from natural gas and ethylene made from natural gas and/or refinery gases, ethane, propane are used internally.)

UNION CARBIDE CHEMICALS CO., Torrance, Calif.
Raw material: Refinery cracked gases (ethylene).
Principal products: Polyethylene, ethylene oxide, and ethylene glycol.

UNION CARBIDE CHEMICALS CO., Whiting, Ind.
Raw material: Refinery gases.
Principal products: Acetic anhydride, acetone, ethanol, ethylene oxide and glycol, isopropanol, methvl ethyl ketone, and methyl isobutyl ketone.
Construction: Building a 72,000,000-lb. per year polyethylene plant.

UNION CARBIDE CORP., Brownsville, Tex.
Project: Union purchased a synthetic-fuels plant from Amoco Chemicals Corp. and is studying plans for possible conversion to petrochemical plant.

UNION CARBIDE PLASTICS CO. (Division of Union Carbide Corp.), Marietta, Ohio.
Raw material: Petroleum-derived stocks.
Principal products: Styrene plastics, phenol, and epoxy resins (15,000,000 lb. per year).

UNION OIL CO. OF CALIFORNIA, Wilmington, Calif.
Raw material: Refinery gases and wastes.
Principal products: Mixture of methyl-ethyl mercaptans.

UNIVERSAL DETERGENTS, INC., Long Beach, Calif.
Raw material: Petroleum fractions.
Principal products: Alkyl naphthalene sulfonates, aromatic solvents, and alkyl naphthalene sulfonate with insignificant foam.

U. S. AIR FORCE, near West Palm Beach, Fla.
Raw material: Fuel oil.
Principal product: Liquid hydrogen. (Facilities for this product built and operated by Air Products, Inc.)

U. S. INDUSTRIAL CHEMICALS CO. (Division of National Distillers & Chemical Corp.), Houston Ship Channel.
Raw material: Ethylene.
Product: Polyethylene (75,000,000 lb. per year).
Construction: Expansion program will double capacity of polyethylene facilities (to 150,000,000 lb. per year) when completed in mid-1960.

U. S. INDUSTRIAL CHEMICALS CO. (Division of National Distillers & Chemical Corp.), Tuscola, Ill.
Raw material: Natural gas (ethane).
Principal products: Ethanol, ethyl ether, ethyl chloride, and polyethylene.

V

VELSICOL CHEMICAL CORP., Marshall, Ill.
Raw material: Petroleum-base stocks.
Principal products: Benzene-1°, benzene motor grade, toluenes, xylenes, high-boiling aromatic petroleum solvents, petroleum-derived formulation solvents, and hydrocarbon polymers and resins.

VICKERS PETROLEUM CO., INC., Potwin, Kan.
Raw material: Catalytic reformate.
Principal products: Benzene (140 bbl. per day), toluene (350 bbl. per day), xylenes (350 bbl. per day), and higher aromatics (300 bbl. per day).

VISCO PRODUCTS CO., INC., Anaheim, Calif.
Raw material: Petroleum fractions and petroleum chemicals.
Principal products: Oil-treating chemicals, demulsifiers, corrosion inhibitors, scale inhibitors, paraffin aids, and water-flood additives.

VISCO PRODUCTS CO., INC., Sugarland, Tex.
Raw materials: Petroleum fractions and petroleum chemicals.
Principal products: Oil-treating chemicals, demulsifiers, corrosion inhibitors, scale inhibitors, paraffin aids, and water-flood additives.

W

WITCO CHEMICAL CO., Chicago.
Raw material: Petroleum naphthenic acid.
Principal products: Metallic naphthenates (paint-drying agents and lube additives).
Raw material: Petroleum wax.
Principal products: Sun-checking inhibitors (rubber compounding).
Raw material: Asphalt fractions.
Principal products: Rubber extenders, saturating compounds, and insulating mastics.
Raw material: Naphthalene.
Principal products: Phthalic anhydride (20,000,000 lb. per year).

WITCO CHEMICAL CO., Lawrenceville, Ill.
Raw material: Solid petroleum tar and heavy liquid and semisolid petroleum fractions.
Principal products: Rubber extenders, extending plasticizers, rubber softeners, roofing asphalts, insulating compounds, and potting compounds.

WITCO CHEMICAL CO., Los Angeles.
Raw material: Naphthenic acids.
Principal products: Metallic naphthenates.

WITCO CHEMICAL CO., Perth Amboy, N. J.
Raw material: Solid petroleum tar and heavy liquid and semisolid petroleum fractions.
Principal products: Rubber extenders, extending plasticizer, rubber softeners, roofing asphalts, potting compounds, and insulating compounds.

WYANDOTTE CHEMICALS CORP., Michigan Alkali Division, Geismar, La.
Raw material: Ethylene and oxygen.
Principal products: Ethylene oxide (60,000,000 lb. per year), ethylene glycol, and diethylene glycol. (Completed this year was a new $26-million chlorine-caustic plant, with daily capacity of 300 tons of chlorine and 330 tons of caustic.

WYANDOTTE CHEMICALS CORP., Michigan Alkali Division, Wyandotte, Mich.
Raw material: Petroleum fractions and derivatives.
Principal products: Alkyl aryl sulfonates, ethylene glycol, diethylene glycol, ethylene dichloride, propylene oxide, polypropylene glycol, polyoxyalkylene compounds, chloroethers, and aromatic distillates and solvents (chlorinated solvents).

PART 2—NITROGEN-CHEMICAL MANUFACTURE

A

ALLIED CHEMICAL CORP., Nitrogen Division, Hopewell, Va.
Raw material: Natural gas.
Principal products: Ammonia (1,100 tons per day), ammonium nitrate-limestone, pebbled ammonium nitrate, nitrogen solutions, sodium nitrate, and nitrogen tetroxide.

ALLIED CHEMICAL CORP., Nitrogen Division, La Platte, Neb.
Raw material: Natural gas.
Principal products: Ammonia (210 tons per day), urea (300 tons per day), and nitrogen solutions.

ALLIED CHEMICAL CORP., Nitrogen Division, South Point, Ohio.
Raw material: Natural gas.
Principal products: Ammonia (875 tons per day), urea (300 tons per day), nitrogen solutions, high-analysis granulated fertilizer, methanol, formaldehyde, and urea-formaldehyde concentrate.

AMERICAN CYANAMID CO., Fortier Plant, Avondale, La.
Raw material: Natural gas.
Principal products: Ammonia (300 tons per day) and ammonium sulfate.

APACHE POWDER CO., Curtiss, Ariz.
Raw material: Natural gas.
Principal product: Anhydrous ammonia (30 tons per day), nitric acid, and ammonium nitrate.

ARMOUR AGRICULTURAL CHEMICAL CO., Nitrogen Division (formerly Mississippi River Chemical Co.), Crystal City, Mo.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day), nitric acid (240 tons per day), ammonium nitrate (200 tons per day), and ammonia solutions.

ATLANTIC REFINING CO., Philadelphia.
Raw material: Byproduct hydrogen from catalytic reformer.
Principal product: Ammonia (165 tons per day).

C

CALIFORNIA-SPRAY CHEMICAL CORP. (subsidiary of California Chemical Co.), Richmond, Calif.
Raw material: Natural and refinery gases.
Principal products: Ammonia (300 tons per day), nitric acid (250 tons per day), ammonium sulfate, ammonium nitrate, and fertilizer solutions.

CALIFORNIA-SPRAY CHEMICAL CORP. (subsidiary of California Chemical Co.), Kennewick, Wash.
Construction: Scheduled for completion this year, the new Kennewick plant will use ammonia to make ammonium nitrate (150 tons per day), complex pelletized fertilizers (250 tons per day), and fertilizer solutions. Cost will be $4,600,000.

CALUMET NITROGEN PRODUCTS CO., (Standard Oil Co. (Ind.) and Sinclair Refining Co.), Hammond, Inc.
Raw material: Hydrogen-rich refinery gas.
Principal products: Anhydrous ammonia and solutions (300 tons per day).

COLLIER CARBON & CHEMICAL CORP., Brea, Calif.
Raw material: Natural gas.
Principal products: Ammonia (320 tons per day), dry ice and liquid CO_2 (165 tons per day), ammonium nitrate, and ammonium phospate.

COMMERCIAL SOLVENTS CORP., Sterlington, La.
Raw material: Natural gas.
Principal products: Ammonia (400 tons per day), ammonium nitrate, and nitrogen solutions.

COOPERATIVE FARM CHEMICALS ASSOCIATION, Lawrence, Kans.
Raw material: Natural gas.
Principal products: Ammonia (180 tons per day), ammonium nitrate, and nitrogen solutions.
Construction: Scheduled for completion this fall are facilities to increase ammonia production from 180 to 270 tons per day, plus a urea plant with capacity of 30 tons of 100% urea daily. This, plus planned nitric acid capacity of 120 tons daily, will provide 100 tons daily of urea nitrate solutions. Nitric acid facilities will be completed early in 1960.

D

DEERE & CO., Grand River Chemical Division, Pryor, Okla.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day), urea (90,000 tons per year), and nitrogen solutions.

DU PONT DE NEMOURS & CO., E. I., Belle, W. Va.
Raw material: Natural gas.
Principal product: Urea (150,000 tons per year), nylon intermediates, and acrylics. (Converting ammonia synthesis from coke-oven gas to natural gas.)

DU PONT DE NEMOURS & CO., E. I., Gibbstown, N. J.
Raw material: Natural gas.
Principal product: Anhydrous ammonia.

E

ESCAMBIA CHEMICAL CORP., Pensacola, Fla.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day), ammonium nitrate, and nitrogen fertilizer solutions.

G

GENERAL PETROLEUM CORP., Torrance, Calif.
Raw material: Refinery streams.
Principal product: Ammonium sulfate.

GONZALEZ CHEMICAL INDUSTRIES, INC., Guanica, Puerto Rico.
Raw material: Selected crude oil.
Principal products: Anhydrous ammonia (42,000 long tons per year) and ammonium sulfate (140,000 tons per year).

GRACE & CO., W. R. (Grace Chemical Division), Memphis, Tenn.
Raw material: Natural gas.
Principal product: Ammonia (300 tons per day) and urea (100,000 tons per year).

H

HERCULES POWDER CO., Hercules, Calif.
Raw material: Natural gas.
Principal products: Ammonia (150 tons per day), urea nitrate (20,000 tons per year), and nitrogen tetroxide (10,000 tons per year).

HERCULES POWDER CO., Louisiana, Mo.
Raw material: Natural gas.
Principal products: Ammonia (115 tons per day).

M

MISSISSIPPI CHEMICAL CORP., Yazoo City, Miss.
Raw material: Natural gas.
Principal products: Ammonia (325 tons per day), ammonium nitrate (500 tons per day), nitric acid (480 tons per day), and urea (100 tons per day).

MONSANTO CHEMICAL CO., Inorganic Chemicals Division, El Dorado, Ark.
Raw material: Natural gas.
Principal products: Ammonia (585 tons per day), ammonium nitrate, ammonium sulfate, nitrogen solutions, aqua ammonia, and urea (100 tons per day).

MONSANTO CHEMICAL CO., Inorganic Chemicals Division, Luling, La.
Raw material: Natural gas.
Principal products: Ammonia (400 tons per day), ammonium nitrate, solid (dry ice) and liquid CO_2 (42 tons per day), and nitrogen solutions.

N

NORTHERN CHEMICALS INDUSTRIES, Searsport, Me.
Raw material: Bunker C fuel oil.
Principal products: Ammonia (125 tons per day) and nitrogen solutions.

O

OLIN MATHIESON CHEMICAL CORP., Lake Charles, La.
Raw material: Natural gas.
Principal products: Ammonia (250 tons per day) and hydrazine.

P

PETROLEUM CHEMICALS, INC., (Cities Service Co. and Continental Oil Co.), Lake Charles, La.
Raw material: Petroleum feed stocks.
Principal products: Ammonia (100,000 tons per year) and oxygen (90 tons per day).

PHILLIPS CHEMICAL CO., Etter, Tex. (Anhydrous ammonia and nitric acid facilities are government leased, with portion of the plant owned by Phillips Chemical).
Raw material: Natural gas.
Principal product: Anhydrous ammonia (191,600 short tons per year).
Raw material: Ammonia.
Principal product: Nitric acid (130,000 short tons per year).
Raw material: Ammonia and nitric acid.
Principal product: Ammonium nitrate (142,000 short tons per year).
Raw material: Ammonia and ammonium nitrate.
Principal product: Nitrogen solutions (55,000 short tons per year).

PHILLIPS CHEMICAL CO., Pasadena, Tex.
Raw material: Natural gas.
Principal product: Anhydrous ammonia (191,600 short tons per year).
Raw material: Ammonia and sulfuric acid.
Principal product: Ammonium sulfate (401,500 short tons per year).

PHILLIPS PACIFIC CHEMICAL CO. (Phillips Petroleum Co. and Pacific Northwest Pipeline Corp.), operated by Phillips Chemical Co., Kennewick, Wash.
Raw material: Natural gas.
Principal product: Anhydrous ammonia (73,000 short tons per year).

R

ROHM & HAAS CO., Pasadena (Deer Park), Tex.
Raw material: Natural gas and ammonia.
Principal product: Hydrogen cyanide.

S

SAN JACINTO CHEMICAL CO., Division of Smith-Douglass Co., Inc., Houston.
Raw material: Natural gas.
Principal product: Anhydrous ammonia (40,000 tons per year).

SHELL CHEMICAL CORP., Shell Point (Pittsburg), Calif.
Raw material: Natural gas.
Principal products: Ammonia (100,000 tons per year), ammonium sulfate, diammonium phosphate, and catalysts.

SHELL CHEMICAL CORP., Ventura, Calif.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day) and urea (100 tons per day).

SMITH DOUGLASS CO., INC., Houston, Tex.
Raw material: Natural gas.
Principal product: Anhydrous ammonia.

SOHIO CHEMICAL CO. (subsidiary of Standard Oil Co. of Ohio), Lima, Ohio.
Raw material: Natural gas and refinery offgas.
Principal products: Anhydrous ammonia (300 tons per day), aqua ammonia, nitrogen solutions and combinations of ammonia, ammonium nitrate, urea solutions, coated 45% or uncoated 46% urea, feed-grade urea, chemical-grade urea, nitric acid, and carbon dioxide.

SOUTHERN NITROGEN CO., INC., Savannah, Ga.
Raw material: Natural gas.
Principal products: Anhydrous ammonia (275 tons per day), aqua ammonia, nitrogen solutions, prilled ammonium nitrate, and urea (10,000 tons per year).

SPENCER CHEMICAL CO., Calumet City, Ill.
Raw material: Methanol and ammonia.
Principal product: Aqua ammonia.

SPENCER CHEMICAL CO., Fort Worth, Tex.
Raw material: Natural gas.
Principal products: Dry ice and liquid CO_2.

SPENCER CHEMICAL CO., Henderson, Ky.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day), nitric acid, ammonia solutions, urea (100 tons per day) and aqua ammonia.

SPENCER CHEMICAL CO., Pittsburg, Kans.
Raw material: Natural gas (hydrogen and carbon monoxide).
Principal products: Ammonia (200 tons per day), nitric acid, aqua ammonia, ammoniating solutions, ammonium nitrate, and dry ice.

SPENCER CHEMICAL CO., Vicksburg, Miss.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day), nitric acid, ammonia solutions, and urea (11,000 tons per year).

STANDARD OIL CO. OF CALIFORNIA, Richmond, Calif.
Raw material: Natural gas.
Principal products: Ammonia and nitric acid.

ST. PAUL AMMONIA PRODUCTS, INC., Pine Bend Plant, South St. Paul, Minn.
Raw material: Natural gas.
Principal products: Ammonia (200 tons per day) and ammonium nitrate solutions.

SUN OIL CO., Marcus Hook, Pa.
Raw material: Hydrogen from cat reformer.
Principal product: Ammonia (300 tons per day).

SUNOLIN CHEMICAL CO. (Sun Oil Co. and Olin Mathieson Chemical Corp.), North Claymont, Del.
Construction: New plant to produce urea from ammonia and carbon dioxide. Capacity of the $8-million project will be 73,000 tons per year when completed in the spring of 1960.

T

TENNESSEE VALLEY AUTHORITY, (noncommercial plant owned and operated by the Government), Wilson Dam, Ala.
Raw material: Natural gas.
Principal product: Ammonia (250 tons per day).

TEXACO INC., Lockport, Ill.
Raw material: Natural gas.
Principal products: Anhydrous ammonia (80 tons per day of refrigeration, commercial, and agricultural grades); aqua ammonia (industrial and agricultural grades); and nitrogen solutions (industrial and agricultural grades).

U

UNION OIL CO. OF CALIFORNIA, Wilmington, Calif.
Raw material: Refinery gases and wastes.
Principal product: Ammonium sulfate (21,000 tons per year).

U. S. INDUSTRIAL CHEMICALS CO. (Division of National Distillers & Chemical Corp.), Tuscola, Ill.
Raw material: Natural gas (ethane).
Principal products: Ammonia and ammonium nitrate.

Other ammonia plants (nonpetrochemical): KETONA CHEMICAL CO., Ketona, Ala. (125 tons per day), and U. S. STEEL, Geneva, Utah (200 tons per day). Ammonia plants using hydrogen from chlorine cells include the following: COLUMBIA-SOUTHERN CHEMICAL CO., Natrium, W. Va. (70 tons per day); DU PONT, Niagara Falls, N. Y. (30 tons per day); HOOKER CHEMICAL CORP., Western Chemical Division, Tacoma, Wash. (60 tons per day); OLIN MATHIESON CHEMICAL CORP., Lake Charles, La. (60 tons per day), and Niagara Falls, N. Y. (20 tons per day); and PENNSALT CHEMICALS CORP., Wyandotte, Mich. (95 tons per day), and Portland, Ore. (20 tons per day).

PART 3—BUTADIENE AND COPOLYMER

(Companies making N-type rubbers and other elastomers are listed in 1. Organics, U. S.)

COPOLYMER (SBR)

AMERICAN SYNTHETIC RUBBER CORP., Louisville, 68,500 long tons per year.

COPOLYMER RUBBER & CHEMICAL CORP., Baton Rouge, La., with plant capacity of 73,500 long tons per year net, or 95,000 long tons per year gross.

FIRESTONE TIRE & RUBBER CO., Synthetic Rubber & Latex Division, Akron, 40,000 long tons per year.

National T-12 Truck Mounted Rig-Up in our Houston Plant yard. Torrance, Cal., is the other port center location where National Supply performs rig-ups for customers all over the world.

This National T-45 Rig-Up will insure a faster start for the customer at the well site. Everything is positioned exactly as it will be used overseas.

On larger rig-ups like this National 110, National often furnishes on request guide photographs of machinery connections and paint-coded parts for reassembly. Equipment boxed for shipment is specially wrapped, sealed and weatherproofed.

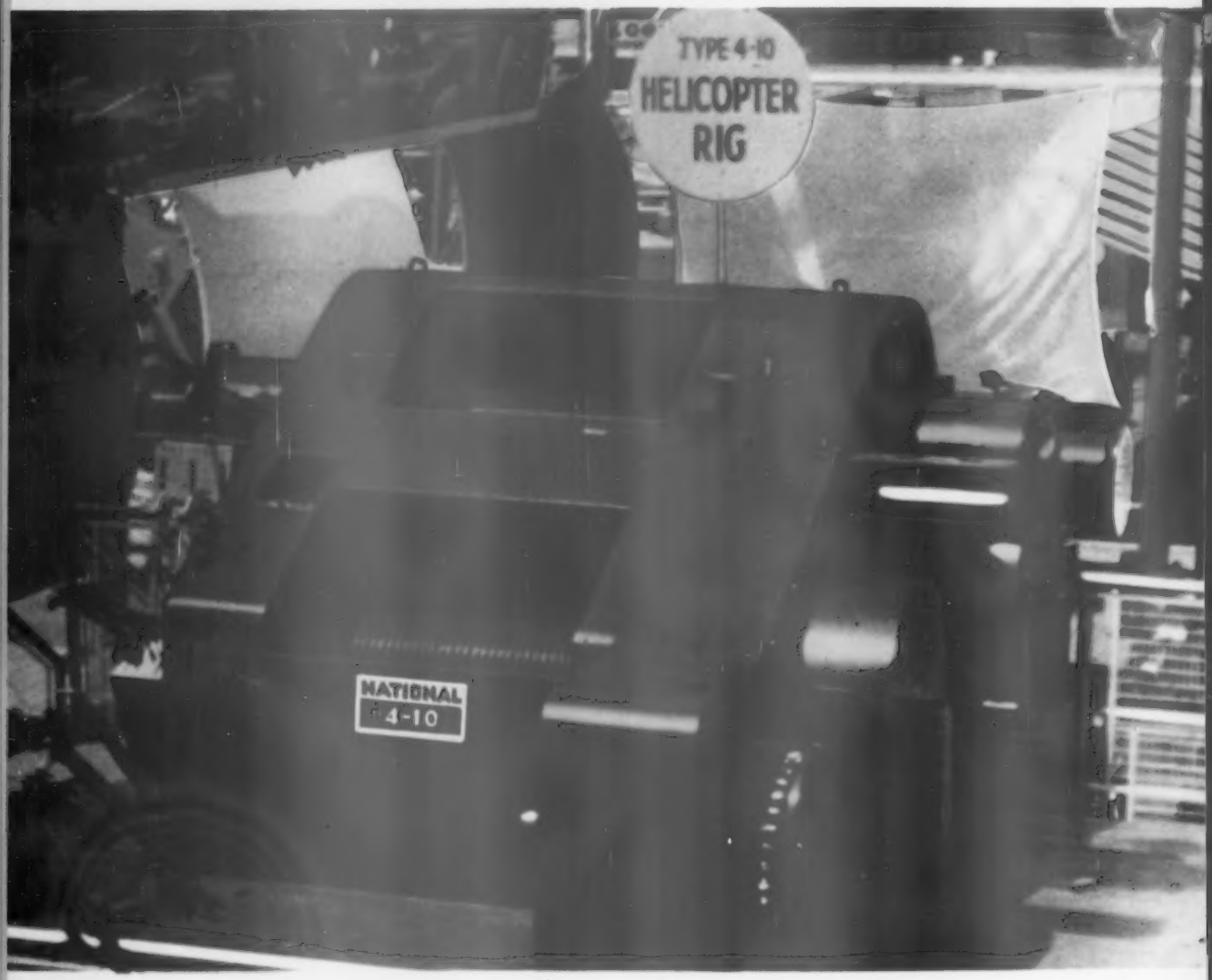
Here's a National 110 Rig that's ready to go! Test operation, lubrication and adjustment of all components, standard procedure in National Supply's complete rig-up service, have all been done.

No rig-up job is too large or small

for NATIONAL SUPPLY...

and it saves you time and money at the site!

You can use this NATIONAL Rig where no rig

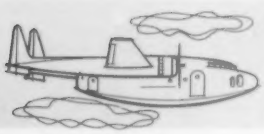


Type 4-10 Helicopter Rig

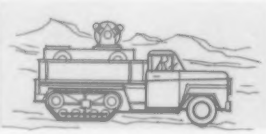
Disassembles into components weighing less than 4,000 pounds

Drills wells to 10,000-foot depth

Can be transported by helicopter

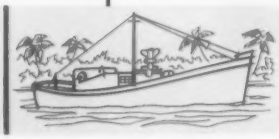


or cargo plane



or track-type vehicle

or light truck

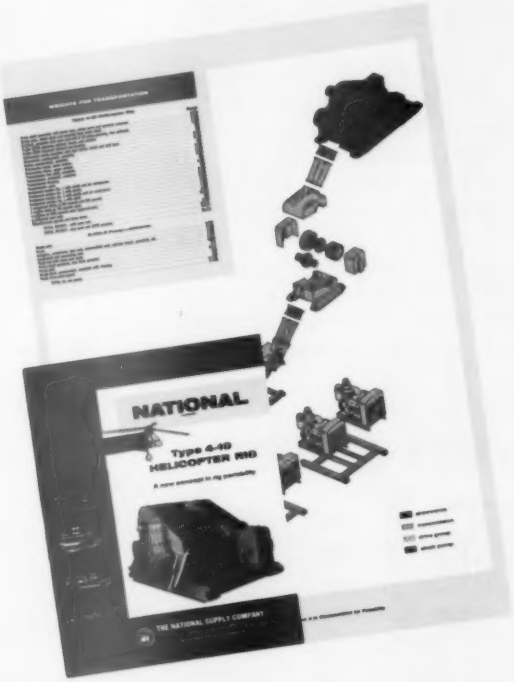


or boat and barges

has gone before and drill to 10,000 feet!

MAIN FEATURES

- Maximum portability makes remote areas accessible
- Easy assembly, with positive alignment and high strength
- "Midship" transmission eliminates long chain drives
- Can be converted to a conventional rig
- Air operation gives precise, synchronized power
- Streamlined panel control promotes easier, safer, more precise operation
- Main drum designed for longer wire line life, better spooling
- Water jacketed brake rims give efficient and continuous cooling
- High capacity clutches need no adjustment—reduce maintenance and parts handling
- Unitized hydromatic brake increases drum brake life
- Rotary drive brake keeps rotary from turning when pipe is lowered
- Rotary drive sprocket permits wide selection of rotary drive ratios
- Two-speed transmission provides flexibility, ease of servicing
- Reverse gears are standard equipment . . . easy to maintain . . . long wearing
- Cascade system gives positive lubrication
- Catshaft operates only when needed . . . for safety and longer life
- Rugged sand reel (optional) has large capacity . . . wear-resistant brake rims
- Main brakes are smooth acting . . . eliminate brake handle "kick-back"
- Torque converter equipment results in faster round trips, better pump performance, improved rotary operation



Be sure you get this new Bulletin

explaining the new Type 4-10 Helicopter Rig, and the new concept of portability that it brings to the industry. A big fold-out page in the bulletin shows you exactly how the rig disassembles for transportation. Ask any National representative for your copy.

More on the next page . . .

This Type 130 Rig, second largest in the National line, is in service on a drilling barge off Louisiana. National Rigs were used in pioneering offshore drilling operations, and have since served or are serving in offshore drilling operations all over the globe.

Why is the NATIONAL Rig first choice?

We manufacture rigs for all drilling needs—for 1,000 to 25,000-ft. wells. We also offer the industry's finest rig-up service, and maintain a worldwide supply service network that is very helpful to operators wherever they may be.

But a broad line, valuable experience, expert rig-up service and fast on-the-spot service are not the basic reasons why National Rigs are most preferred. The main reason is this: There are no compromises in the design or materials of National Rigs. In fact, each one has some extra built-in stamina that many National Rig users call the "Drillers' Margin" that makes an important performance difference on every well.

However they express it, operators the world over know this—and they like to tackle the big, difficult jobs with National Rigs. That's why *eight successive world's depth record wells,* from 16,655 feet to 25,340 feet, have been drilled with National Rigs. That's why almost half of all wells over 15,000 feet are drilled with National Rigs.

You judge National Rigs by what they actually do for you. And that's why they're first choice.

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

TWO GATEWAY CENTER, PITTSBURGH, PA.

DIVISION OFFICES: Calgary, Dallas, Denver, Houston, Toledo, Torrance, Tulsa

EXPORT: 600 Fifth Avenue, New York 20, N.Y., U.S.A.; City Wall House, Chiswell Street, London E.C.1

Litho in U. S. A.

FIRESTONE TIRE & RUBBER CO., Synthetic Rubber & Latex Division, Lake Charles, La., 190,000 long tons per year.

GENERAL RUBBER SYNTHETIC CORP. General Tire & Rubber Co., Odessa, Tex., 40,000 long tons per year (cold SBR, oil extended; black master-batch and combinations).

GOODRICH-GULF CHEMICALS, INC., Institute, W. Va., 122,000 long tons per year.

GOODRICH-GULF CHEMICALS, INC., Port Neches, Tex., 90,000 long tons per year.

GOODYEAR TIRE & RUBBER CO., Akron, 27,500 long tons per year.

GOODYEAR TIRE & RUBBER CO., Houston, 220,000 long tons per year.

NAUGATUCK CHEMICAL, Division of United States Rubber Co., Naugatuck, Conn., 30,000 long tons per year.

PHILLIPS CHEMICAL CO., Borger, Tex., 108,000 long tons per year.

SHELL CHEMICAL CORP., Torrance, Calif., 110,000 long tons per year.

TEXAS-U. S. CHEMICAL CO., Port Neches, Tex., 143,000 gross long tons per year.

UNITED CARBON CO., INC., Baytown, Tex., 50,000 long tons per year.

BUTYL RUBBER (IIR)

ESSO STANDARD OIL CO., Baton Rouge, La., 60,000 long tons per year.

Construction: This year's construction includes a plant to produce chlorinated butyl rubber and facilities to manufacture butyl latex. Raw materials used will be liquid fractions and unsaturated gas. In 1960, expansion will include facilities for brominated butyl rubber, using liquid fractions as a raw material. Also, improvements will be made to butyl rubber feed-stock facilities in 1960.

HUMBLE OIL & REFINING CO., Baytown, Tex., 57,500 long tons per year.

BUTADIENE

ALLIED CHEMICAL CORP., Tonawanda, N. Y., estimated 4,000 short tons per year (ethylene cracking byproduct).

COPOLYMER RUBBER & CHEMICAL CORP., Baton Rouge, La., 38,000 short tons per year.

DOW CHEMICAL CO., Midland, Mich., and Freeport, Tex., with combined capacity of 17,400 short tons per year (butadiene is ethylene cracking byproduct).

ESSO STANDARD OIL CO., Baton Rouge, La., 55,100 short tons per year (butadiene is ethylene cracking byproduct).

FIRESTONE TIRE & RUBBER CO., Synthetic Rubber & Latex Division, Orange, Tex., 40,000 short tons per year.

Construction: Expansion program will boost capacity of this plant by 30,000 tons per year. Facilities for production of butadiene-based rubber will be completed by late 1960. Facilities for production of isoprene-based rubber are scheduled for completion early in 1961.

HUMBLE OIL & REFINING CO., Baytown, Tex., 65,000 short tons per year.

NECHES BUTANE PRODUCTS CO. (Goodrich-Gulf Chemicals Co. and Texas-U. S. Chemical Co.), Port Neches, Tex., 295,000 short tons per year.

ODESSA BUTADIENE CO., Odessa, Tex., 50,000 short tons per year.

PETROLEUM CHEMICALS, INC., (Cities Service Co. and Continental Oil Co.), Lake Charles, La., 80,000 short tons per year.

PETRO-TEX CHEMICAL CORP., Houston, 200,000 short tons per year.

PHILLIPS CHEMICAL CORP., Borger, Tex., 112,000 short tons per year.

SHELL CHEMICAL CORP., Torrance, Calif., 70,000 short tons per year. (Isoprene-rubber was being produced at a rate averaging 5 tons per day earlier in 1959, but this was expected to be increased to 15,000 to 20,000 tons annually on a steady basis.)

STANDARD OIL CO. OF CALIFORNIA, El Segundo, Calif., (butadiene-butylene mixtures)—16,000 short tons per year butadiene and 1,870 bbl. per day butylene.

TEXAS BUTADIENE & CHEMICAL CORP., Houston, 65,000 short tons per year (can be increased to 85,000 depending on amount of alkylate and aviation gasoline also made at this plant).

UNION CARBIDE CHEMICALS CO., South Charleston, W. Va., Texas City, Tex., and Seadrift, Tex., with combined capacity of 35,000 short tons per year (butadiene is ethylene cracking byproduct).

PART 4—SULFUR CONVERSION

FROM SOUR NATURAL GAS

COLUMBIAN CARBON CO., Seminole, Tex.

FOOD MACHINERY & CHEMICALS CORP., Westvaco Chlor-Alkali Division, South Charleston, W. Va.

GULF OIL CORP., Crane County, Tex.

JEFFERSON LAKE SULPHUR CO., Manderson, Wyo., 50 tons per day.

MONSANTO CHEMICAL CO., Lion Oil Company Division, Magnolia, Ark., 10-12 tons per day.

OLIN MATHIESON CHEMICAL CORP., McKamie, Ark., 100 tons per day.

PAN AMERICAN PETROLEUM CORP., plans to produce sulfur from sour natural gas in Eddy County, New Mexico. Capacity will be 7½ tons per day.

PAN AMERICAN PETROLEUM CORP., Elk Basin, Wyo., 100 tons per day.

PAN AMERICAN PETROLEUM CORP., Midland Farms, Tex., 11 tons per day.

PAN AMERICAN PETROLEUM CORP., Odessa (North Cowden), Tex., 17 tons per day.

PAN AMERICAN PETROLEUM CORP., Sundown, Tex., 42 tons per day.

PAN AMERICAN PETROLEUM CORP., Worland, Wyo., 20 tons per day.

PARKER, J. L., Andrews, Tex., 15 tons per day.

PARKER, J. L., Madill, Okla., 15 tons per day.

PARKER, J. L., Penwell, Tex., 30 tons per day.

PHILLIPS CHEMICAL CO., Goldsmith and Crane, Tex., two plants with capacity of 73,000 long tons per year.

RICHARDSON GASOLINE CO., SID, Kermit, Tex., 10 tons per day.

RICHARDSON GASOLINE CO., SID, Odessa, Tex., 20 tons per day.

SEABOARD OIL CO. OF DELAWARE, Powell, Wyo., with capacity of 50 long tons per day.

SHAMROCK OIL & GAS CORP., Sunray, Tex., 30 long tons per day, representing total capacity from both sour natural gas and refinery gas.

SIGNAL OIL CO., Tioga, N. D., 50 tons per day.

STAUFFER CHEMICAL CO., Le Moyne, Ala., with capacity of 127 long tons per day.

TEXACO-SEABOARD, INC. (subsidiary of Texaco, Inc.), Silver Tip field, Wyoming, 50 long tons per day.

TEXAS GULF SULPHUR CO., Worland, Wyo., 400 tons per day.

TIDEWATER OIL CO. will build a new processing plant in New Hope-Smackover field of Northeast Texas. Products will include 224 tons of sulfur per day.

WARREN PETROLEUM CO., Waddel, Tex., 50 tons per day.

FROM REFINERY GAS

ALLIED CHEMICAL CORP., General Chemical Division, Bayonne, N. J., 30 tons per day.

ALLIED CHEMICAL CORP., General Chemical Division, Richmond, Calif., 100 long tons per day.

AMERICAN OIL CO., Yorktown, Va., 50 tons per day.

APACHE POWDER CO., Curtiss, Ariz., 80 tons of sulfuric acid daily.

ATLANTIC REFINING CO., Philadelphia, refinery gas to sulfuric acid.

AURORA GASOLINE CO., Detroit, 27 long tons per day.

CONSOLIDATED CHEMICAL INDUSTRIES, INC., Baton Rouge, La., 30 long tons per day, and two plants at Baytown, Tex., total of 194 tons per day.

DIXON CHEMICAL INDUSTRIES is building a sulfuric acid plant (sludge-burning) at Paulsboro, N. J.

EL PASO NATURAL GAS CO., operator, Eunice, N. M., 30 tons per day.

FREEPORT SULPHUR CO., Westville, N. J., 30 tons per day.

GREAT NORTHERN OIL CO., Pine Bend, Minn., 50 tons per day.

GULF OIL CORP., plants at Port Arthur, Tex., and Philadelphia.

HANCOCK CHEMICAL CO., Watson, Calif., 200 tons per day.

MOBIL OIL CO., Paulsboro, N. J., 80 tons per day.

MONSANTO CHEMICAL CO. and **TIDEWATER OIL CO.**, Avon, Calif., use byproduct hydrogen sulfide and spent alkylation acid from Tidewater's refinery to make sulfuric acid (340 tons per day).

MONTANA SULPHUR & CHEMICAL CO., Billings, Mont., 40 tons per day.

PURE OIL CO., Lemont, Ill., 20 tons per day.

SHAMROCK OIL & GAS CORP., Sunray, Tex., 30 tons per day, representing total capacity from both sour natural gas and refinery gas (also listed under Sour Natural Gas).

SHELL CHEMICAL CORP., Houston.

SINCLAIR REFINING CO., Houston, 30 tons per day.

SINCLAIR REFINING CO., Marcus Hook, Pa.

STANDARD OIL CO. (IND.), Whiting, Ind., 62 short tons per day.

STAUFFER CHEMICAL CO., Consolidated Chemical Industries Division, Baton Rouge, La., refinery sludge acid and sulfur to sulfuric acid, including facilities for sulfur manufacture from refinery H_2S gas stream.

STAUFFER CHEMICAL CO., Consolidated Chemical Industries Division, Baytown, Tex., more than 100 tons per day.

STAUFFER CHEMICAL CO., Consolidated Chemical Industries Division, Hammond, Ind., refinery spent acid is used to make virgin sulfuric acid. Capacity of new plant, completed early in 1959, is 500 tons daily.

STAUFFER CHEMICAL CO., Consolidated Chemical Industries Division, Houston, Tex., sulfuric acid from refinery sludge.

STAUFFER CHEMICAL CO., Dominguez, Calif., sulfuric acid from refinery sludge acid or H_2S.

SUN OIL CO., Marcus Hook, Pa., 30 tons per day.

SUN OIL CO., Toledo, Ohio, 12½ tons per day.

TEXACO, INC., Los Angeles, Calif.

TIDEWATER OIL CO., Delaware City, Del., 275 tons per day.

UNION OIL CO. OF CALIFORNIA, Oleum, Calif., 25,000 tons per year.

UNION OIL CO. OF CALIFORNIA, Santa Maria, Calif., two plants with combined capacity of 17,500 tons per year.

UNION OIL CO. OF CALIFORNIA, Wilmington, Calif., 16,000 tons per year.

WILSHIRE OIL CO. OF CALIFORNIA, Santa Fe Springs, Calif., 20 tons per day.

PART 5—CARBON BLACK

FURNACE PROCESS

CABOT CARBON CO., Big Spring, Tex.; Franklin, La.; Pampa, Tex.; and Ville Platte, La. (Combined gas throughput 48,000,000 cu. ft. per day; oil throughput 4,000 bbl. per day.)

COLUMBIAN CARBON CO., Conroe, Tex.; El Dorado, Ark.; Eola, La.; Hickok, Kans.; North Bend, La.; and Seagraves, Tex.

CONTINENTAL CARBON CO., Eunice, N. M.; Lake Charles, La.; Ponca City, Okla. (75,000,000 lb. per year); and Sunray, Tex.
Construction: The Lake Charles plant is being expanded, increasing annual capacity from 45,000,000 to 70,000,000 lb. of high abrasive carbon black. Completion of the $2-million program is scheduled late this year.

HUBER CORP., J. M., Baytown, Tex. (110 tons per day), and Borger, Tex. (120 tons per day).

PHILLIPS CHEMICAL CO., Borger, Tex. (290,000,000 lb. per year).

SHELL CHEMICAL CORP., Shell Point, Calif.

THERMATOMIC CARBON CO., Division of Commercial Solvents Corp., Sterlington, La. (thermal type).

UNITED CARBON CO., Aransas Pass, Tex.; Franklin, La.; Ryus, Kans.; and Shamrock, Tex.

CHANNEL PROCESS

CABOT CARBON CO., Kermit, Tex., and Skellytown, Tex. (Combined throughput 60,000,000 cu. ft. per day.)

COLTEXO CORP., Lefors, Tex. (32,000,000 cu. ft. per day gas throughput).

COLUMBIAN CARBON CO., Coltexo, Tex.; Eunice, N. M.; Lefors, Tex.; Seagraves, Tex.; and Sweeny, Tex.

HUBER CORP., J. M., Borger, Tex., (74 tons per day).

RICHARDSON CARBON CO., SID, Odessa, Tex. (75,000,000 lb. per year).

UNITED CARBON CO., Aransas Pass, Tex. (20,000,000 cu. ft. per day throughput); Eunice, N. M. (96,000 lb. per day); and Falfurrias, Tex. (12,000 lb. per day).

ROLLER PROCESS

CARBON BLACKS, INC., Rayville, La., (high-grade color blacks only—120,000 lb. per year).

COLUMBIAN CARBON CO., Gray County, Texas (12,000,000 cu. ft. per day throughput); and Peerless Carbon Black Division, Sweeny, Tex. (5,000,000 cu. ft. per day throughput).

PETROCHEMICAL PLANTS OUTSIDE THE U. S.

Canada

B-A SHAWINIGAN, LTD. (British American Oil Co. and Shawinigan Chemical), Montreal, Que.
Raw material: Cumene.
Principal products: Phenol (more than 25,000,000 lb. per year), acetone (more than 15,000,000 lb. per year, isopropanol, methyl styrene, and bis-phenol.

BRITISH AMERICAN OIL CO., LTD., Montreal, Que.
Raw material: Propylene and benzene.
Principal product: Cumene.

BRITISH AMERICAN OIL CO., LTD., Nevis field, Alberta.
Construction: Expansion of gas plant will increase capacity from 15,000 to 35,000 M.c.f. daily and will include new sulfur facilities. Completion is scheduled fall 1959.

BRITISH AMERICAN OIL CO., LTD., Pincher Creek, Alta, 675 long tons of sulfur from plant processing 120,000 M.c.f. daily of wet-sour gas.
Construction: Raw-gas capacity will be

increased to 180,000 M.c.f. per day by September 1959.

CABOT CARBON CO. OF CANADA, LTD., Sarnia, Ont.
Raw material: Petroleum fractions.
Principal product: Oil-type furnace black (more than 55,000,000 lb. per year).

CANADIAN CHEMICAL CO., LTD. (subsidiary of Celanese Chemical Corp.), Edmonton, Alta.
Raw material: Butane and propane.
Principal products: Pentaerythritol (8,500 tons per year), methanol, propylene glycol, dipropylene glycol, n-propanol, n-propyl acetate, acetic acid, acetone, other alcohols, glycols, aldehydes, oxides, ketones and cellulose acetates. (Cellulose acetate capacity is 12,500 tons per year.)

CANADIAN INDUSTRIES, LTD., Edmonton, Alta.
Raw material: Natural gas, from which ethane is obtained.
Principal product: Polyethylene (22,000,000 lb. per year).
Construction: Will complete fall 1959, an increase in polyethylene capacity from 22,000,000 lb. to 40,000,000 lb. per year.

CANADIAN INDUSTRIES, LTD., Millhaven, Ont.
Raw material: Ethylene glycol and dimethylester and terephthalic acid.
Principal products: Synthetic polyester fiber and flake.
Raw material: Bunker C fuel oil.
Principal product: Anhydrous ammonia (200 tons per day).

CANADIAN OIL COMPANIES, LTD., Sarnia plant, Corunna, Ont.
Raw material: Refinery streams.
Principal products: Benzene, toluene xylene, aromatic solvents, paraffinic solvents, hydrogen, methane, ethane, ethylene, propane-propene, and butane-butene.

CARBIDE CHEMICALS CO. (Division of Union Carbide Canada, Ltd.), Montreal East, Que.
Raw material: Refinery gases.
Principal products: Ethylene (captive), ethylene oxide, ethylene glycols (50,000,000 lb. per year), polyethylene glycols, glycol ethers, ethanolamines, and polyethylene (40,000,000 lb. per year).
Construction: Polyethylene capacity will be increased to 65,000,000 lb. per year by mid-1960.

CONSOLIDATED MINING & SMELTING CO. OF CANADA, LTD., Turner Siding, Alta.
Raw material: Natural gas.
Principal products: Ammonia (325 tons per day), ammonium nitrate (200 tons per day), and sulfur (20 tons per day).
Construction: Urea plant at Calgary, with capacity of 36,000 tons per year. Completion of the $5,000,000 project is scheduled in 1960.

CYANAMID OF CANADA, LTD., Welland, Ont.
Construction: Scheduled for completion next year is a $5-million conversion program in which natural gas replaces coal as raw material for making ammonia and ammonium nitrate.

DEVON - PALMER OILS, LTD., and **TEXAS GULF SULPHUR CO., INC.**, Calgary, Alta.
Raw material: Sour natural gas.
Product: Sulfur (370 long tons per day).

DOW CHEMICAL OF CANADA, LTD., Sarnia, Ont.
Raw material: Hydrocarbon-rich stream, benzene, and butadiene.
Principal products: Carbon tetrachloride, diethanolamine, diethylene glycol, dichloroethyl ether, ethanolamine ethyl chloride, ethylene glycol, ethylene oxide, hydrochloric acid, perchloroethylene, polystyrene, polystyrene foam, styrene, styrene butadiene latexes, trichloroethylene, triethanolamine, triethylene glycol, and ammonia. Introduced in the past year were polyethylene, expandable polystyrene beads, methyl chloride, and methylene chloride.
Construction: Engineering studies are under way for caustic soda chlorine, and phenol operations in western Canada. The caustic and chlorine will lead to certain petrochemicals almost immediately, but the range has not yet been decided.

DU PONT CO. OF CANADA, LTD., Maitland, Ont.
Raw material: Cyclohexane, ammonia, carbon tetrachloride, chloroform, polyacrylonitrile, and hydrofluoric acid.
Principal products: Adipic acid, hexamethylene diamine (nylon intermediates), chlorofluoromethanes, acrylic fiber, and hydrogen peroxide. (Du Pont also makes nylon resin at Kingston, Ont.).

DU PONT CO. OF CANADA, LTD., Sarnia, Ont.
Construction: Startup scheduled first quarter of 1960 at new low-pressure-process polyethylene plant.

ETHYL CORP. OF CANADA, LTD., Sarnia, Ont.
Raw material: Ethyl chloride, ethylene dichloride, and ethylene dibromide.
Principal product: Tetraethyl lead.

IMPERIAL OIL, LTD., Sarnia, Ont.
Raw material: Petroleum gas and liquid fractions.
Principal products: Tripropylene (nonene), tetrapropylene (tetramer), detergent alkylate (30,000,000 lb. per year of alkyl aryl benzene), alkylate bottoms aliphatic solvents, ethylene, propylene, butadiene, butylenes, aromatic distillates, aromatic tars, and petroleum polymers.

IRVING REFINING, LTD., St. Johns, N. B., 30 long tons of sulfur per day.

JEFFERSON LAKE PETROCHEMICALS OF CANADA, LTD., Alberta.
Construction: Plans call for building two new sulfur-recovery plants—one just east of Calgary and the other in the Savanna Creek area. The first is expected on stream in November 1960.

JEFFERSON LAKE PETROCHEMICALS OF CANADA, LTD., Fort St. John, B. C., 300 tons per day of sulfur from sour natural gas.

LAURENTIDE CHEMICALS & SULPHUR, LTD., Montreal East, Que., 100 tons per day of sulfur from natural gas.

LUBRIZOL OF CANADA, LTD., Niagara Falls, Ont.
Raw material: Petroleum fractions.
Principal product: Lube-oil additives.

MONSANTO CANADA, LTD., Montreal, Que.
Raw material: Styrene.
Principal product: Polystyrene.

NEW SURPASS PETROCHEMICALS, LTD., Scarborough, Ont.
Raw material: Petroleum fraction polyalkylated benzene and petroleum oxidates.
Principal products: Petroleum sulfonates and derivatives, corrosion inhibitors, oil additives, rust preventives, esters, and lubricating greases (calcium, lithium, bentone, etc.).

NORTHWEST NITRO - CHEMICALS, LTD., Medicine Hat, Alta.
Raw material: Natural gas.
Principal products: Ammonia, high-analysis nitrogen, and phosphate fertilizers.

POLYMER CORP., LTD. (Crown owned), Red Deer, Alta.
Construction: In planning stage is a $15-million butadiene plant with proposed capacity between 25,000 and 30,000 tons per year.

POLYMER CORP., LTD. (Crown owned), Sarnia, Ont.
Raw material: Refinery streams.
Principal products: Styrene and butadiene monomers, styrene butadiene, butyl and nitrile rubbers, ethylene, isobutylene, and specialty latices. (Production of all types of rubber in 1958 was 135,000 long tons.)

REICHHOLD CHEMICALS (CANADA), Port Moody, B. C.
Construction: In the formative stage are plans for a phenol and formaldehyde unit.

ROYALITE OIL CO., Turner Valley, Alta., 25 to 40 tons per day of sulfur from H_2S from natural gas.

SHELL OIL CO. OF CANADA, LTD., Jumping Pound, Alta., 90 long tons per day of sulfur from sour natural gas.

SHELL OIL CO. OF CANADA, LTD., Montreal, Que.
Raw material: Propylene, butylenes, and benzene.
Principal products: Isopropyl alcohol, acetone, secondary butyl alcohol, methyl ethyl ketone, epoxy resins, and detergent alkylate.

SHERRITT GORDON MINES, Fort Saskatchewan, Alta.
Raw material: Natural gas.
Principal products: Ammonia (180 tons per day) and ammonium sulfate 100,000 tons per year).

STEELMAN GAS, LTD., Steelman, Sask., 7½ long tons of sulfur per day from natural gas.

ST. MAURICE CHEMICALS, Division of

Building Structures for the PETROCHEMICAL INDUSTRY is a specialty and an art . . .

Petrochemicals have come a long way since the wooden storage barrels used in the early days. Increasingly complex refinery processes have created demands for storage vessels and process equipment which can be met only by the most exacting attention to materials, design, fabrication and erection.

Over the years, the ability of CB&I to provide a single, responsible and *coordinated* facility for these services has been reflected three ways:

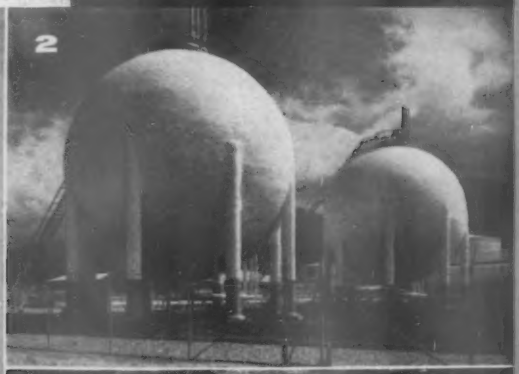
1 In the *performance* records of CB&I-built refinery structures in service throughout the world.

2 In an increasing *demand* for CB&I's services and the applied metallurgical facilities which have made these performance records possible.

3 In CB&I's stepped up *program of metallurgical progress* . . . aimed at developing better fabrication, welding and testing procedures—which have placed new corrosion-resistant metals and alloys, such as Hortonclad® at the disposal of CB&I customers.

This is why—wherever chemical or petroleum products are processed or stored, you'll find CB&I *Craftsmanship in Steel*. For further details write your nearest CB&I office for the bulletin: *CB&I Special Plate Structures.*

IN STORAGE:



Write your nearest CB&I office for the new bulletin on HORTONCLAD —the CB&I composite metal having an integral and continuous bond produced by a high vacuum bonding process.

. with CB&I

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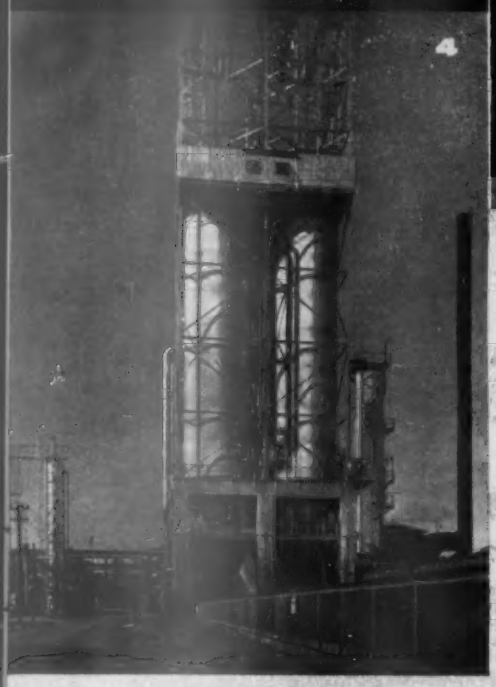
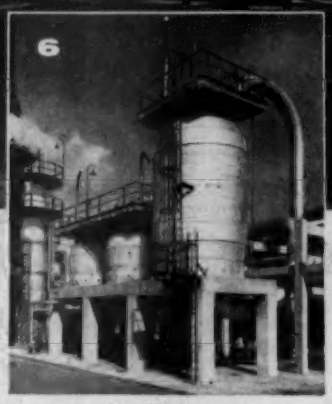




1 **PRESSURE VESSELS.** CB&I furnished 19 Hortonspheres® through the Flour Corporation, for the multi-million dollar *Texas Butadiene and Chemical Corporation* plant near Houston, Texas.

2 **T-1 STEEL** construction makes it possible for these two Hortonspheres to do the work of 20 mild steel tanks . . . in propane service—*Compania Shell de Venezuela.*

3 **WORLD'S LARGEST ALUMINUM TANK.** Stores 83% corrosive ammonium nitrate . . . is 164 ft. in diameter and 24-ft. high.

4 **COKING CHAMBERS** of stainless steel Hortonclad were fabricated and erected by CB&I at a Kansas Refinery.

5 **HORTONCLAD.** 124-ft. high crude columns (left) and 125-ft. vacuum column (right) were partially clad using stainless steel and monel Hortonclad.

6 **HOUDRIFORMER.** Three CB&I-built reactors are used in high severity reforming process unit—to convert low octane naphtha into high octane blending stocks. Plate thickness is 5 inches.

C42SCB

Chicago Bridge & Iron Company

SUBSIDIARIES

Brazil—Chicago Bridge Construções Ltda., Rio de Janeiro • Canada—Horton Steel Works Limited, Toronto • England—Chicago Bridge Limited, London • Venezuela—Chicago Bridge & Iron Company, Ltd., Caracas

OFFICES: Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston • Kansas City (Mo.) • New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City • San Francisco • Seattle • South Pasadena • Tulsa

PLANTS: Birmingham, Alabama • Chicago, Illinois • Greenville, Pennsylvania • Salt Lake City, Utah • New Castle, Delaware

REPRESENTATIVES and LICENSEES

Argentina—Jorge G. Butler, Reconquista 558, Buenos Aires • Australia—Evans Deakin & Co. Ltd., Brisbane; Bernard-Smith (Pty.) Limited, Alexandria (Sydney) • Cuba—W. P. Bryant, Edificio Abreu 402, Havana • England—Whessoe Limited, Darlington • France—Constructions Metalliques de Provence, Aries-sur-Rhone; S. A. Ateliers et Chantiers de la Seine Maritime, Le Trait • Germany—Wilke-Werke AG, Braunschweig; Gutehoffnungshutte, Oberhausen-Sterkrade • Italy—Compagnia Tecnica Industrie Petroli, Rome • Japan—Ishikawajima Heavy Industries Co., Ltd.; Toyo Menka Kaisha, Ltd., Tokyo • Netherlands—Comprimo N. V., Amsterdam • Scotland—The Motherwell Bridge & Engineering Co., Ltd., Motherwell

Shawinigan Chemicals, Ltd., Varennes, Que.
Raw material: Methanol.
Principal products: Formaldehyde and pentaerythritol.

SUN OIL CO., LTD., Sarnia, Ont.
Raw material: Crude oil.
Principal products: Butylenes.

TEXACO CANADA, LTD., Montreal East, Que.
Raw material: Refinery gases.
Principal product: Ethylene.

TEXACO CANADA, LTD., Edmonton, Alta.
Raw materials: Propane-butane.
Principal product: Feed stocks for petrochemicals.

Argentina

INDUSTRIAS PLASTICAS ARGENTINAS KOPPERS, S.A. (Koppers Co., Inc., and private Argentina interests), at La Plata near Buenos Aires.
Construction: Scheduled for completion by 1961 are three plants: ethylene (using refinery gas as feed stock); polyethylene (initial capacity of 15,000,000 lb. per year); and styrene monomer (33,000,000 lb. per year). Estimated cost is $24 million. The styrene plant will supply monomer to polystyrene plastic manufacturers and will have sufficient capacity to supply monomer for anticipated manufacture of synthetic rubber in Argentina.

MONSANTO CHEMICAL, Buenos Aires.
Construction. Phthalic anhydride plant.

TEXAS BUTADIENE & CHEMICAL CORP., Comodoro Rivadavia.
Construction: Scheduled for completion in 1962 are these three plants: butadiene (30,000 tons per year); synthetic rubber (40,000 tons per year); and a carbon-black plant. The new complex will cost an estimated $40 million. Gas in the area will provide the feed stock.

Australia

AUSTRALIA SYNTHETIC RUBBER CO. (Stanvac and Goodyear Tyre & Rubber Co.), Altona.
Construction: An $11-million synthetic-rubber plant is scheduled to open by mid-1961. It will be adjacent to Vacuum's ethylene plant.

AUSTRALIAN PETROCHEMICALS, LTD. (Monsanto Chemicals, Ltd. and Petroleum & Chemicals Corp.), Silverwater near Sydney.
Construction: The country's first styrene monomer plant is scheduled for completion in 1961. It will cost about $4.5 million.

CSR CHEMICALS, PTY., LTD., OF AUSTRALIA, Rhodes, N.S.W.
Principal product: High-impact polystyrene plastic.

CSR-DOW, PTY., LTD. (Dow Chemical Co. and CSR Chemicals, Pty., Ltd.), at Altona near Melbourne.
Construction: New plant to produce styrene for use in making synthetic rubber and plastics. It will be adjacent to Vacuum's ethylene plant.

IMPERIAL CHEMICAL INDUSTRIES.
Project: Polyethylene plant.

SHELL CHEMICAL (AUSTRALIA), Clyde.
Project: Epoxy-resin plant to cost $2,250,000.

UNION CARBIDE AUSTRALIA, LTD., Melbourne.
Construction: New polyethylene unit, with capacity of 15,000,000 lb. per year, is scheduled to go on stream in 1961. It will be adjacent to Vacuum's plant.

VACUUM OIL, PTY., LTD., at Altona near Melbourne.
Construction: Ethylene-butadiene plant. Raw material will come from Standard-Vacuum's Altona refinery. Products from this unit will furnish raw materials for other plants slated nearby.

Austria

DANUBIA PETROCHEMIE, A.G., near Vienna.
Construction: New plant with capacity of 5,000 tons per year of polypropylene plastic will open in 1960. Feed stock will come from the new Schwechat refinery.

HAIG WERKE, A.G.
Principal product: Methanol.

Belgium

COBENAM, S.A. (subsidiary of Union Carbide Corp. and Ste. Chimique des Derives du Petrole S.A.—Petrochim), Antwerp.
Construction: Polyethylene plant with capacity of 30,000,000 lb. per year is scheduled to go on stream in mid-1960.

STE. CHIMIQUE DES DERIVES DU PETROLE, Antwerp.
Construction: New ethylene oxide plant completed earlier this year, and contract let to Scientific Design Co., Inc., for another, with completion expected by 1960.

Brazil

ALBA (BORDEN), at Cubatao near Sao Paulo.
Construction: Facilities to produce methanol, formaldehyde, synthetic resins, with daily capacity of 30 tons.

CONTINENTAL CARBON-CELANESE.
Construction: Carbon-black plant.

INDUSTRIA CHEMICA BRAZIL.
Construction: Ziegler type polyethylene plant planned.

NORTH AMERICAN SOLVAY, INC., Sao Paulo.
Principal product: Ethylene (purification).
Construction: Low-pressure polyethylene production due in 1961.

PETROLEO BRASILEIRO, S.A., near Rio.
Construction: Petrobras has signed contract with Firestone Tire & Rubber Co., and Goodyear Tire & Rubber Co., to install a synthetic-rubber plant near Petrobras' refinery. The project would cost $6 million.

PETROLEO BRASILEIRO, S.A., Cubatao near Sao Paulo.
Raw material: Refinery gas.
Product: Ammonia.
Construction: Urea plant.

UNION CARBIDE, Cubatao.
Raw material: Refinery feed stocks.
Product: Polyethylene (4,500 tons per year).

Colombia

INDUSTRIA COLOMBIANA DE FERTIZANTES (Montecatini), Barrancabermeja (El Centro).
Raw material: Natural gas.
Product: Ammonia.

Czechoslovakia

CZECHOSLOVAKIAN GOVERNMENT.
Project: Synthetic-rubber plant, with annual capacity of 30,000 metric tons when first half is completed in 1963.

Formosa

CHINESE PETROLEUM CORP., Kaohsiung.
Project: Sulfur plant.

France

ANTAR PETROLES DE L'ATLANTIQUE, Donges.
Raw material: Aromatic and paraffinic hydrocarbons.
Principal products: Propylene, benzene, toluene, xylenes, and solvents.

AQUITAINE CHIMIE, Lacq.
Project: Facilities for using methane for production of acetylene and ammonia.

AZOLACQ, Lacq.
Project: Facilities using ammonia for production of nitrogen fertilizers and urea.

BOZEL-NOBEL, Port Jerome.
Raw material: Refinery gas.
Product: Sulfur.

CIE. FRANCAISE DE RAFFINAGE, La Mede.
Product: Propylene.

CIE. FRANCAISE DE RAFFINAGE, Gonfreville.
Principal products: Tetrapropylene, tripropylene, and heptane.
Construction: Ethylene plant with capacity of 30,000 tons per year was scheduled for completion in 1959.

CIE. FRANCAISE DU CARBON BLACK, S.A. (Continental Carbon Co. and Phillips Petroleum Co.), at Bec d'Ambes (Bordeaux).
Construction: New carbon-black plant, with capacity of 25,000 metric tons

annually, is scheduled for completion late in 1960.

ESSO STANDARD, Port Jerome.
Raw material: Propylene.
Principal products: Tetrapropylene and tripropylene.
Construction: New plant to include facilities to produce ethylene, propylene, butadiene, and other raw materials.

ETHYLENE PLASTIQUES-NORMANDIE, Port Jerome.
Project: Facilities for production of high-pressure polyethylene from ethylene.

KUHLMANN, Paimboeuf.
Raw material: Fuel oil.
Principal product: Ammonia.

LORRAINE-DIEUZE, Moselle.
Construction: Polyethylene facilities.

MANOLENE (Manufacture Normande de Polyethylene), Gonfreville.
Raw material: Ethylene.
Principal product: Polyethylene.
Construction: New facilities.

METHANOLACQ, Lacq.
Project: Facilities for production of methanol, using residual natural gas from the Aquitaine Chimie plant at Lacq.

NAPHTACHIMIE, Lavera.
Raw material: Naphtha and kerosine.
Principal products: Ethylene, propylene, butadiene, ethylene oxide (13,200,000 lb. per year), glycol (5,500,000 lb.), ethanolamines (5,500,000 lb.), glycol ethers et cetera (2,200,000 lb.), acetone (11,000,000 lb.), and isopropanol (19,800,000 lb.).
Construction: New 6,000-ton per year ethylene oxide plant is scheduled for completion in 1960. New butadiene plant, with capacity of 6,000 to 7,000 tons, is planned.

OFFICE NATIONAL INDUSTRIEL DE L'AZOTE, Toulouse.
Raw material: Heavy fuel oils.
Principal products: Acetylene, ammonia, and methanol.

PECHINEY, St. Auban.
Raw material: Propane.
Principal products: Perchlorethylene and carbon tetrachloride.
Construction: Polypropylene will be produced under license agreement signed with Montecatini. Plant will have capacity of 2,000,000 lb. per year.

PIERREFITTE, at Pierrefitte.
Raw material: Natural gas.
Product: Ammonia.

POTASSE ET ENGRAIS CHIMIQUES, Grand Couronne.
Principal product: Ammonia.

REICHOLD CHEMICALS, INC., Niort.
Construction: New plant to produce 73,000 tons per year of formaldehyde.

RHODIACETA, St. Fons.
Project: New plant to produce terephthalates from paraxylene and ethyleneglycol.

ST. GOBAIN, Balaruc.
Raw material: Refinery gas.
Product: Sulfur.

ST. GOBAIN, Port de Bouc.
Raw material: Refinery gas.
Product: Sulfur.

SHELL-ST. GOBAIN, Berre.
Raw materials: Propylene, butylene, and heavy cracked residuals.
Principal products: Isopropanol, diacetone, alcohol, butyl acetone, epoxy resins, carbon black, base materials for detergents, and an expanded range of organic solvents.
Construction: New plant, with capacity of 50,000 tons of SBR synthetic rubber annually, will be completed in 1961.

SHELL-ST. GOBAIN, Petit Couronne.
Raw material: C_8-plus kerosine.
Principal products: Alkyl sulfate of soda for use in detergents.

SIDA, La Chambre.
Raw material: Isopropanol and secondary butanol.
Principal products: Diacetone alcohol, acetone, and methylethyl ketone.

SIDA, Notre-Dame de Gravenchon.
Construction: Plant for manufacture of butanol.

STE. ATLANTIQUE PROGIL ELECTROCHIMIE, Donges.
Raw materials: Propylene and benzene.
Principal product: Cumene.

STE. CABOT-FRANCE, Berre.
Principal product: Carbon black.

STE. CHIMIQUE DE LA GRANDE PAROISSE, Grand Quevilly.
Raw material: Refinery gas.
Product: Ammonia.

STE. CHIMIQUE DES DERIVES DU PETROLE.
Project: Scientific Design Co., Inc., has contract to build new ethylene oxide plant for this company.

STE. DE PRODUITS CHIMIQUES COURRIERES-KUHLMANN, Harnes.
Raw materials: Dimers of butylene and propylene, and trimers of propylene.
Principal product: Dodecylbenzene and oxo alcohols.

STE. DE PRODUITS CHIMIQUES MARLES-KUHLMANN, Chocques.
Raw material: Propylene.
Principal products: Propylene oxide and derivatives for use in polyester resins.

STE. D'ELECTROCHIMIE, D'ELECTROMETALLURGIE ET DES ACIERES ELECTRIQUES D'UGINE, Villers St. Sepulchre.
Project: Facilities for production of latex rubber, using butadiene and styrene as raw material.

STE. DE PRODUITS CHIMIQUES MARLES-KUHLMANN, Gonfreville.
Construction: Facilities for ethylene oxide and derivatives.

STE. DES USINES CHIMIQUES RHONE-POULENC, Peage de Roussillon.
Raw materials: Propylene, benzene, and cumene.
Principal products: Cumene, acetone, and phenol.

STE. DU CAOUTCHOUC BUTYL, Port Jerome.
Raw material: Isobutene.
Principal products: Butadiene and butyl rubber (20,000 tons per year).

STE. NATIONALE DES PETROLES D'AQUITAINE, Lacq.
Raw material: Natural gas from Lacq field.
Principal products: Ethylene and sulfur.
Project: Facilities for making acetylene, methanol, and ammonia have been proposed.

STE. NORMANDE DE MATIERES PLASTIQUES.
Construction: Polypropylene will be produced by this company at a plant with capacity of 22,000,000 lb. per year to be built under agreement signed with Montecatini. Ethylene will be the raw material.

STE. PETROSYNTHESE, Gonfreville.
Raw materials: Benzene and tetrapropylene.
Principal product: Dodecylbenzene.

STE. PROGIL-ELECTROCHIMIE, Pont de Claix.
Raw material: Cumene.
Principal products: Acetone and phenol.
Construction: New plant to make perchlorethylene and carbon tetrachloride.

STE. STANDARD-KUHLMANN, l'Estane.
Raw material: Aromatic alkyls.
Principal product: Detergents (19,800,000 lb. per year).

West Germany

BADISCHE ANILIN- & SODA-FABRIK, Ludwigshafen.
Products: Styrene, polyethylene, methanol, isopropanol, and acetone.

B. P. BENZIN UND PET A.G., Dinslaken.
Project: Ethylene plant.

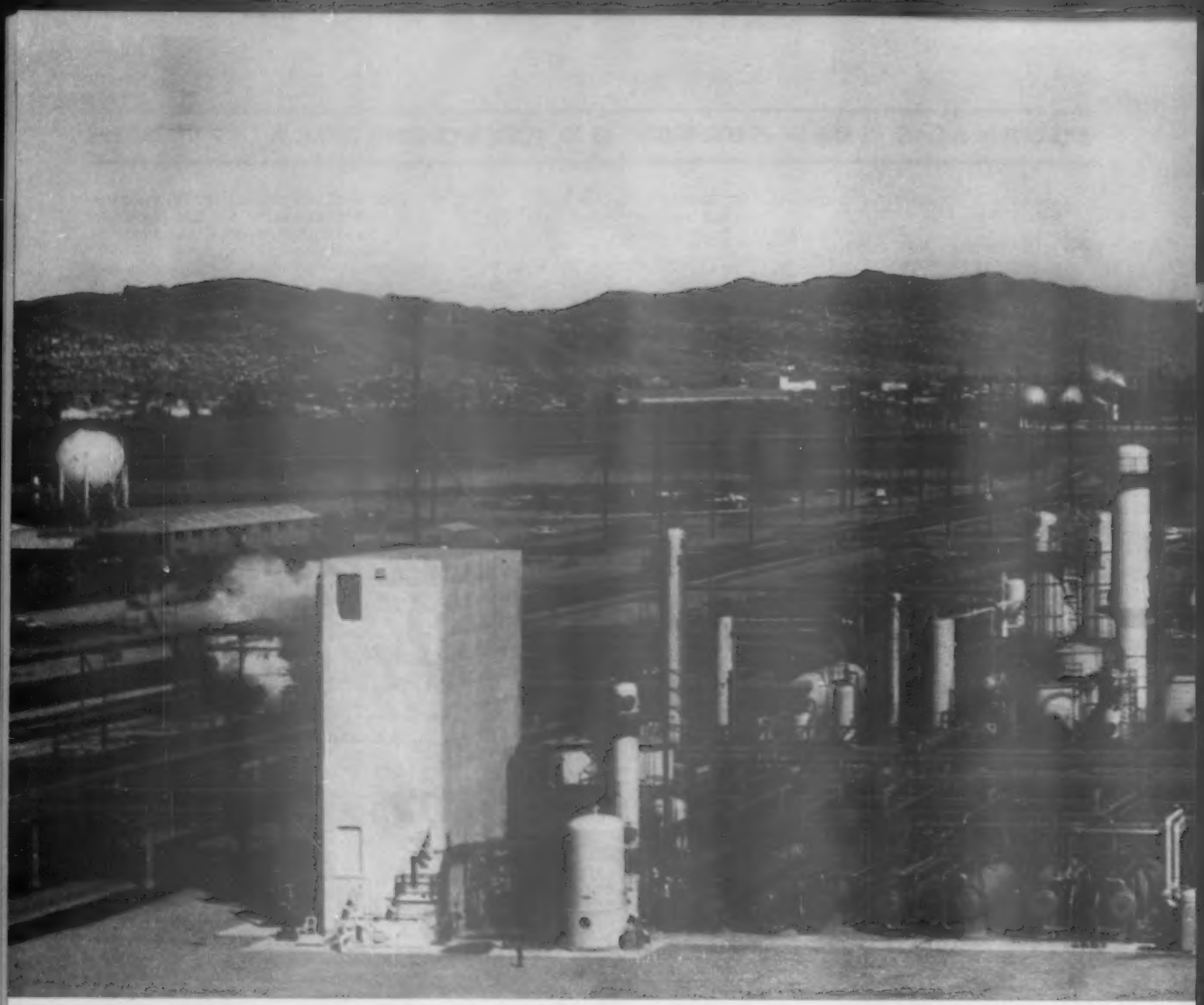
BUNA WERKE HUELS G.M.B.H., Marl.
Products: Butadiene, styrene, copolymer and synthetic rubber.
Construction: Expanding capacity from 40,000 to 70,000 tons per year.

CHEMISCHE WERKE HUELS, Marl.
Raw material: Natural gas, LPG, and coal gas for acetylene plant which is the base for most operations.
Products: Ethylene, polyethylene, ethanol, styrene, ethylene oxide, cumene, and dodecylbenzene. Styrene capacity is 160,000,000 lb. per year.

CHEMISCHE WERKE HOLTEN, Oberhausen.
Products: Ethylene oxide and glycol from plant placed on stream in 1959. Estimated capacity is 44,000,000 lb. per year.

DEUTSCHE ERDOEL, Heide.
Product: Purified ethylene (2,000,000 lb. per year).

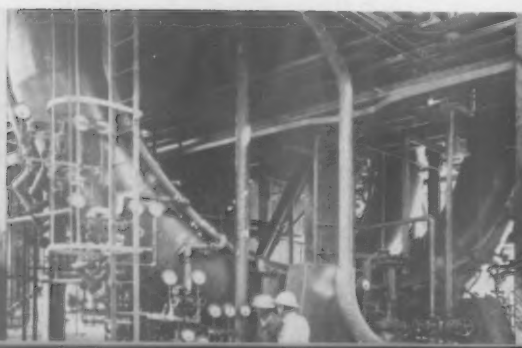
DEUTSCHE SHELL, near Cologne.
Raw material: Refinery gases.

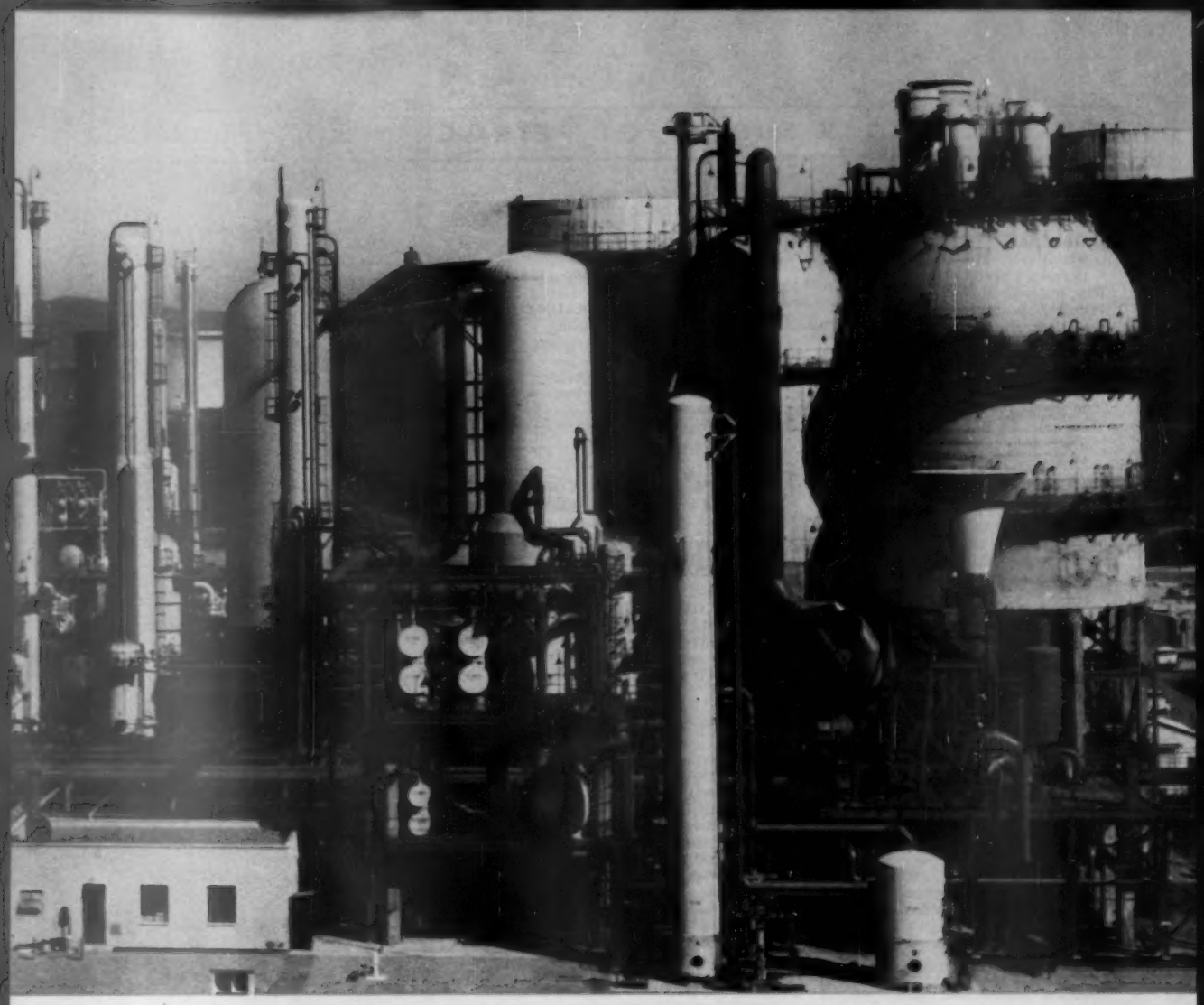


What's new in cat crackers?

The art of catalytic cracking has reached a highly advanced state. The improvements and refinements that now take place as new crackers are built seem minor indeed when one recalls the series of spectacular breakthroughs that followed one after another during cat-cracking's first eventful decade.

Yet there is drama even today. Sometimes it takes the form of a successful race against time. A record of sorts was set recently when the unit above was completed by Fluor for Standard Oil Company of California at its Richmond refinery on San Francisco Bay. It is an Esso Model IV





Fluid Catalytic Cracker with a capacity of 55,000 barrels per day, and it was delivered to the customer in time for the summer marketing season—two weeks less than one year after work began.

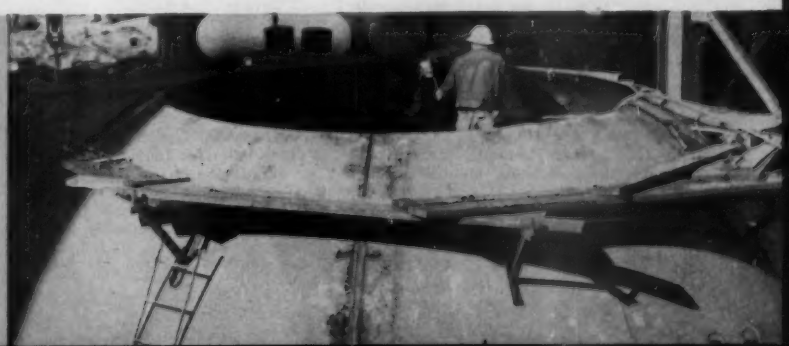
It is one of the two largest Model IV's in existence. The other, of the same capacity, was built by Fluor in 1954 for Standard at El Segundo. The Richmond and El Segundo units are almost identical except for auxiliaries (Richmond has a fired heater, a CO boiler and water-treating facilities). A few minor design and material changes, based on experience at El Segundo, were incorporated into the new unit.

The job was begun on June 2, 1958, and completed May 15, 1959. Credit for the fast completion is due to many factors—organization, planning, fine co-operation from customer and suppliers, and good luck. But perhaps the most important element of all was Fluor's broad experience in the design, engineering and construction of cat crackers—nearly thirty of them since 1940.

A Fluor brochure, "FCC at Richmond," describes this interesting unit. Write to Dept. 53, The Fluor Corporation, Ltd., 2500 South Atlantic Boulevard, Los Angeles 22, California.

When you consider expansion...
the most important investment you can make
is in the creative ability of men

FLUOR
Engineers & Constructors



Product: Ethylene, used at adjacent plant of Rheinische Olefinwerke.

ERDOELCHEMIE G.M.B.H. (Farbenfabriken Bayer and British Petroleum), Dormagen near Cologne.
Raw material: Refinery feed stocks.
Principal products: Benzene, ethylene, ethylene glycol, ethylene oxide, propylene, butylene, butadiene.
Construction: New ethylene oxide plant is scheduled for completion by the end of this year, boosting total capacity to 79,300,000 lb. per year. Also under construction is a new ethanol plant, which will have estimated capacity of 40,000,000 lb. per year.

ESSO A.G., Cologne.
Raw material: From refinery.
Principal products: Ethylene, propylene (35,000 tons annually), butadiene (7,500 tons annually), isomeric butylene, methane, ethane, hydrogen, and acetylene.

FARBWERKE HOECHST, A.G., Gendorf.
Products: Ethylene oxide and glycol, other glycols and derivatives, detergents, nylon, emulsifiers, lacquers, antifreeze compounds, textile and agricultural chemicals, polyvinyl chloride, polypropylene, and other plastics. A new plant provides alternate source for ethylene oxide and glycol. Methane chlorination products made from natural use.

FARBWERKE HOECHST, Hoechst.
Raw material: Petroleum distillates.
Products: Ethylene, propylene, ethanol, isopropanol, acetone, polyethylene, polypropylene, and fibers and films.
Construction: New ethylene and acetylene plants under construction. When completed, olefin capacity will be an estimated 130,000,000 lb. per year.

FARBENFABRIKEN BAYER, Leverkusen.
Products: Rubber and fibers.

FELDMUBLE, Lulsdorf.
Project: Ethylene plant (10,000 tons per year) and propylene plant.

HIBERNIA, Herne.
Products: Ethylene and polypropylene.

KOHLE-OEL-CHEMIE, Gelsenkirchen.
Product: Polyethylene.

PHENOLCHEMIE, Gladbeck.
Products: Phenol and acetone.

RHEINISCHE OLEFINWERKE (owned 50% by Shell and 50% by Badische Aniline- & Soda-Fabrik), Wesseling near Cologne.
Raw materials: Refinery gases and light naphthas.
Products: Ethyl benzene (12,000 tons per year), epoxy resins (2,000 tons), ethylene (102,000,000 lb. per year), high-pressure polyethylene (35,000 tons), and low-pressure polyethylene (6,000 tons).
Construction: Expanding ethylene capacity to an estimated 275,000,000 lb. per year by 1962.

RHEINPRUSSEN, Homberg.
Products: Dodecylbenzene, ethanol, acetone, butyl alcohols, and isopropanol.

ROHM & HAAS, Darmstadt.
Product: Acrylic resins.

RUHRCHEMIE, Oberhausen.
Products: Polyethylene and styrene.

SCHOLVEN-CHEMIE, A.G., near Gelsenkirchen.
Project: Low-pressure polyethylene plant.

UNION RHEINISCHE BRAUNKOHLEN-KRAFTSTOFF, Wesseling.
Project: 9,000-ton per year urea plant.

WACKER CHEMIE, Burghausen.
Products: Trichloroethylene and vinyl acetate.

India

ALKALI & CHEMICAL CORP. (subsidiary of Imperial Chemical), West Bengal.
Principal product: Polyethylene (3,500 tons per year). This $8.4-million project was completed in 1959 and is the nation's first major polyethylene plant.

INDIA GOVERNMENT
Proposals: A government committee has approved plan for a $50-million fertilizer plant near Bombay. Refinery gases and fuel oil would be used. Capacity would be equal to 80,000 tons per year of fixed nitrogen. Also under consideration is a synthetic rubber plant at Bareilly.

NATIONAL CARBON INDIA, near Bombay.
Project: A 3,500-ton per year polyethylene plant was scheduled in 1959.

Indonesia

INDONESIAN GOVERNMENT, near Palembang, Sumatra.
Construction: A $30-million ammonia plant is scheduled for completion in 1962. It will produce 330 tons daily of fertilizer-grade prilled urea. Raw material will be natural gas from Radja field.

Iran

IRANIAN GOVERNMENT, near Shiraz.
Construction: Montecatini has contract for construction of a nitrogen-fertilizer plant, with capacity of 110 tons per day. Natural gas will be the raw material.

Italy

ANIC, Ravenna.
Raw material: Methane and refinery butane.
Principal products: Ammonia, nitrogen fertilizer (750,000 tons a year), acetylene, butadiene for synthetic rubber (60,000 tons a year), styrene monomer, and ethylene.

ABCD, Ragusa.
Principal products: Ethylene, propylene, butylene, and derivatives.
Construction: High-pressure polythene plant wiith capacity of 25 tons per day.

APPLICAZIONI CHIMICHE SOCIETA AZIONI, Milan.
Principal product: Fibers.

COLUMBIAN CARBON EUROPA, near Milan.
Construction: A $6-million plant to produce 60,000,000 lb. of carbon black per year is planned. Completion is scheduled early in 1961.

DISTILLERIE ITALIENNE, Milan.
Project: Butanol plant.

FTALITAL, S.P.A.
Project: Facilities for production of maleic anhydride.

MONTECATINI, Terni.
Construction: New plant with capacity of 10,000,000 lb. per year of polypropylene staple fiber and continuous thread.

MONTECATINI, Novara.
Raw material: Methane.
Principal products: Ammonia, methyl alcohol, and acetylene.

MONTECATINI, Rho (near Milan).
Raw materials: Liquid hydrocarbons and refinery gases.

MONTECATINI, Ferrara.
Raw materials: Methane, liquid hydrocarbons, refinery gases.
Principal products: These include ammonia and polypropylene.
Construction: Expansion of polypropylene facilities.

MONTECATINI, Brindisi.
Construction: Work has started on a $95-million petrochemical complex, one of the largest in Europe. At least 1,300,000 tons of raw materials will be used annually for production of polyethylene, isotactic polypropylene, polymers for synthetic fibers, aldehydes, alcohols, and organic solvents.

SICEDISON, Marghera.
Raw material: Methane.
Principal products: Ammonia, acetylene, and acetic and vinyl derivatives.

SICEDISON, Mantua.
Raw material: Liquid hydrocarbons and refinery gas.

SINCAT (Industriale Catonese and Cia. Edison affiliate), Syracuse.
Raw material: From Rasion refinery at Augusta.
Principal products: Olefins, especially ethylene and propylene.

SINCAT, Prioli, Sicily.
Project: Ammonia plant (240 metric tons per day) and ethylene plant.

SIRE, Porto Torres, Sardinia.
Project: New plant for ethylene, propylene, ethanol, and propylene tetramer production.

SIRE, Milan.
Product: Dodecylbenzene.

SISAS, Milan.
Raw material: Methane.
Principal products: Acetylene and acetic derivatives.

SIRE, Varese.
Products: Propylene tetramer and cumene-phenol.

How Okonite makes a longer-lived high voltage power cable for petroleum and petrochemical applications

This Okolene 405 shielded power cable—developed by Okonite—is especially suited to petroleum and petrochemical applications, where petroleum products and chemicals can produce severe environmental conditions.

These constructional details, backed by Okonite's 80 years of manufacturing dependable cables, make Okolene 405 the best power cable developed to date for petroleum and petrochemical use up to 35kv.

1. The copper conductor is covered with a layer of Semicon* semi-conducting tape. This eliminates internal corona that could lead to dielectric failure.

2. Okolene 405 insulation is a premium grade high voltage polyethylene dielectric which has proved in service its moisture resistance, and resistance to petroleum oils, paraffinic hydrocarbons, mineral acids and alkalies. Electrically stable, it has low capacity and low loss characteristics.

3. A layer of elastic semi-conducting compound—followed by a woven semi-conducting tape—is applied to assure intimate electrical contact at all times between the shielding tape and the Okolene 405 insulation. This prevents corona discharge which could damage the insulation and cause eventual outage.

4. Okolene 405 cables are further shielded with a substantial .005-inch metallic tape.

5. A cable binder tape is applied over the metallic shielding tape to assure the flexibility needed for easy handling.

6. One of three synthetic resin protective jackets is provided according to the environmental conditions... Okoseal 500, a high quality, general purpose PVC jacket compound... Okoseal 300, a premium grade PVC compound with unusual stability in higher temperatures... or Okolene 800, a premium grade molecular weight black polyethylene compound. All three jacket compounds are highly resistant to a variety of petroleum and petrochemical environmental hazards as well as weathering.

7. The finished product, checked against all quality control standards during manufacturing, is put through its paces in Okonite's modern final-testing laboratory, and is ready for years of service in your plant.

For the full story on Okolene 405 shielded high voltage power cable, ask your Okonite representative—or write for free Bulletin OG—2125 to The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, New Jersey.

7289

*Okonite registered trade name

where there's electrical power...

there's **OKONITE CABLE**

Congrats and $25 to Mr. D. J. SUGGS, Republic Natural Gas Co., Tipton Bldg., Pauls Valley, Okla., for this quip.

Joe Roughneck is top kick of the industry . . and plenty tough in his pipe demands.

He likes the plus factors he gets in using Lone Star electric weld pipe: convenient source of dependable supply, overnight delivery and rigid quality control through exacting multiple tests.

Sound, strong, lasting pipe you can depend upon: API casing, tubing and line pipe from Lone Star.

Neighbor, wherever you are, specify Lone Star and we both get a good deal.

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PETROCHEMICAL SURVEY

SNIA VISCOSA, near Milan.
Construction: New carbon disulfide plant, using natural gas. Completion is due in 1960. Products will be used to manufacture rayon.

SOC. CHIMICA RAVENNA (Associated with ANIC), Ravenna.
Principal products: Vinyl chloride.

SOC. CABOT ITALIANA (an affiliate of Cabot Laboratories, Boston), Ravenna.
Construction: A 14,000-ton per year carbon-black plant. Estimated cost of the project is $3 million.

SOC. SOLVAY, Italy.
Project: Plant for marlex polythene production.

SOLVIC, Rosignano.
Principal product: Polyethylene.

S.P.A. CELENE (jointly owned by Union Carbide & Societa Edison), near Priolí, Sicily.
Construction: Facilities for production of polyethylene, ethylene oxide, and derivatives. New plants are due on stream in 1960.

VETROCOKE, Marghera.
Raw material: Methane.
Principal product: Ammonia.

Japan

ASAHI-DOW, LTD., Kawasaki.
Raw material: Ethylene.
Construction: New facilities for production of styrene monomer from ethylene scheduled to go on stream by October 1959. Capacity will be 18,000 tons per year.

FURUKAWA CHEMICAL INDUSTRY CO., LTD., Kawasaki.
Raw material: Ethylene.
Principal product: Polyethylene (9,000 tons per year).

JAPAN CATALYTIC CHEMICAL IND. CO., LTD., (owned mainly by Sumitomo Group), Kawasaki.
Raw material: Ethylene.
Principal products: Ethylene oxide (1,800 tons yearly) and ethylene glycol (3,840 tons).

JAPANESE GEON CO., LTD., (owned by Furukawa Group and 35% by B. F. Goodrich), Kawasaki.
Raw material: Butadiene and styrene monomer.
Principal products: SBR (5,000 tons yearly), high styrene rubber (1,200 tons), and NBR (1,500 tons).

KYOWA FERMENTATION INDUSTRY CO., LTD., Ube.
Construction: $20,000,000 plant to produce butanol and octanol from naphtha.

MARUSEN OIL CO., LTD., Shimotsu, Wakayama prefecture.
Raw material: Refinery gas.
Principal product: Secondary butanol (2,400 tons per year) and methyl-ethyl-ketone (1,850 tons).

MARUZEN OIL CO., LTD., Matsuyama.
Principal products: Benzene (6,240 tons per year), toluene (6,000 tons), and xylenes (9,600 tons).
Construction: Scheduled for completion in April 1960 are facilities for production of benzoic acid (898 tons per year), phthalic anhydride (2,042 tons), isophthalic acid (5,012 tons), and terephthalic acid (2,215 tons).

MITSUBISHI MONSANTO CHEMICAL CO. (owned by Mitsubishi Kasei and Monsanto Chemical Co.), Yokkaichi.
Principal product: Polystyrene (6,000 tons annually).

MITSUBISHI OIL CO., LTD., (owned by the Mitsubishi Group and 50% by Tidewater Oil Co.), Kawasaki.
Principal product: Benzene (4,700 tons annually), toluene (3,500 tons), and xylenes (3,000 tons).
Project: New plans for various dibasic acids, such as benzoinic acid, phthalic anyhydride, isophthalic acids.

MITSUBISHI PETROCHEMICAL CO., LTD., Yokkaichi.
Raw material: Naphtha and refinery gas.
Principal products: Ethylene (22,000 tons per year for own use), polyethylene (10,000 tons per year), and styrene monomer (18,000 tons).
Construction: New facilities for production of ethylene oxide (2,700 tons annually) and ethylene glycol (3,000 tons annually) scheduled to go on stream by October 1959.

MITSUBISHI VONNEL CO., LTD. (jointly owned by Mitsubishi and Chemstrand Corp.), Hiroshima.
Principal product: Acrylic fiber.

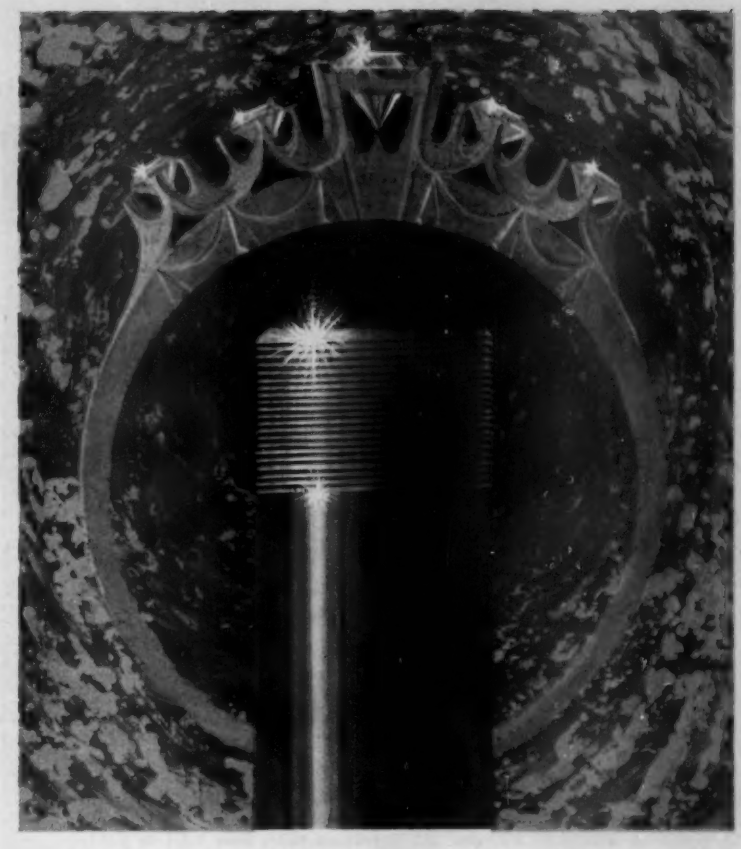
MITSUI PETROCHEMICAL INDUSTRIES, LTD., Iwakuni, Yamaguchi prefecture.
Raw materials: Petroleum fractions and refinery gas.
Principal products: Ethylene (26,000 tons annually), polyethylene (12,000 tons per year), ethylene oxide (2,400 tons), ethylene glycol (4,800 tons), phenol (12,000 tons), acetone (6,840 tons), benzene (8,760 tons), toluene (11,220 tons), xylenes (11,220 tons), and terephthalic acid (6,000 tons).

NIPPON PETROCHEMICALS CO., LTD., Kawasaki, Kanagawa prefecture.
Raw materials: Naphtha.
Principal products: Isopropanol (2,000 tons annually), acetone (3,500 tons), ethylene (35,000 tons), and butadiene (5,150 tons).

NIPPON SYNTHETIC RUBBER CO., LTD., Yokkaichi.
Construction: Facilities for production of SBR scheduled to go on stream in October 1959. Capacity will be 45,000 tons per year.

SHOWA YUKA K.K., (owned by Showa Denko Co. and others, with no relationship to Showa Oil Co.), Kawasaki.
Raw materials: Ethylene.
Principal product: Polyethylene (10,000 tons per year).

SUMITOMO CHEMICAL CO., LTD., Niihama.
Raw material: Naphtha.
Principal products: Ethylene (12,000



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OF THE
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INDUSTRY

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Lone Star men are more than mere steelworkers . . they are true craftsmen. They take personal pride in their work and in their fine products.
Oil and gas men, on the other hand, appreciate Lone Star pipe because it is a fine, dependable product, and because its convenience and availability right here in the oil country save much precious time. Truly . . the gem of the oil and gas industry.

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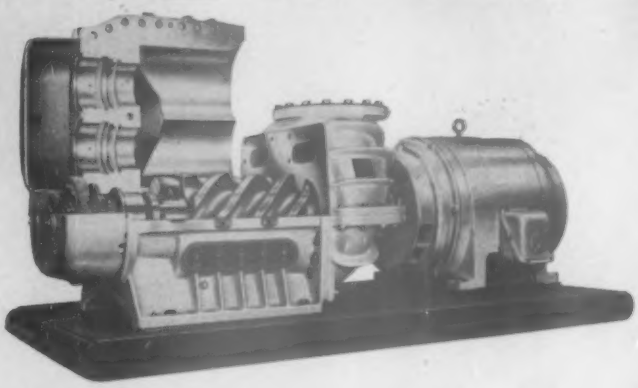
You'll find this is

the only rotary compressor

with all these features!



Fairbanks-Morse Positive Displacement Axial-Flow Rotary Compressors are available in standard models in single-stage units, with capacities from 800 to 12,500 cfm. at compression ratios from 1.6:1 to 5.0:1—or in two-stage units with capacities from 2,000 to 12,500 cfm. at compression ratios above 5.0:1—and for booster service at maximum working pressures up to 250 psig.

- **High efficiency and stability** that rivals reciprocating machines.
- **Low weight and small space** requirement that cuts costs for installation, foundation and building.
- **Oil-free output**—no metal-to-metal contact of impellers or casing, no lubrication of parts contacting gas, air or vapor.
- **Mechanical simplicity**—no valves, no pistons or reciprocating parts to wear or replace.
- **Adaptability to any power source** permits choice of induction or synchronous motor, diesel engine, gas or steam turbine as prime mover.
- **Smooth, steady operation**—impeller speed and design produce even delivery of flow with minimum pulsation or vibration.

For complete information contact your nearby Fairbanks-Morse Branch, or write Fairbanks, Morse & Co., 600 So. Michigan Ave., Chicago 5, Ill. Ask for new Bulletin ACO 100.2.

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COMPRESSORS • PUMPS • SCALES • DIESEL, DUAL FUEL AND GAS ENGINES
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tons yearly for own use) and polyethylene (11,000 tons yearly).
Construction: Agreement signed with Ste. Belge de l'Azote for design of facilities for production of acetylene and ethylene from liquid hydrocarbons.

Korea

KOREAN GOVERNMENT, Chung-Ju.
Construction: Urea plant, with capacity of 285 tons.

Mexico

PETROLEOS MEXICANOS.
Project: Mexico's Government oil agency has negotiated $50-million credit with a group of four French banks, with the money to be used primarily to finance a new petrochemical industry.

PETROLEOS MEXICANOS, Salamanca.
Construction: Contract for a 220-ton per day anhydrous ammonia plant has been awarded Lummus Co.

PETROLEOS MEXICANOS, Ciudad Madero near Tampico.
Construction: Sulfur plant.

PETROLEOS MEXICANOS
Construction: Contract was recently signed with Fluor Corp. to build at least one of three anhydrous ammonia plants in Mexico.

PETROLEOS MEXICANOS, Tampico.
Construction: Carbon-black plant is reported under consideration.

PETROLEOS MEXICANOS, Atzcapotzalco near Mexico City.
Construction: A 6,800-ton per year low-pressure polyethylene plant is expected to open in 1959, under license from Phillips Petroleum Co.

Netherlands

CONTINENTAL CARBON - NETHERLANDS (Continental Oil Co., Shamrock Oil & Gas Corp., and Witco Chemical Co.), Rotterdam.
Construction: Scheduled for completion in early 1960 is a new plant with annual capacity of 30,000,000 lb. of high abrasive carbon black. The plant will cost about $2.5 million.

CALTEX PETROLEUM MAATSCHAPPIJ (NEDERLAND), Pernis.
Raw material: Refinery gas.
Product: Sulfur (8 long tons per day).

E. I. DU PONT DE NEMOURS & CO., Dordrecht.
Project: Plans call for construction of a plant with capacity of 15,000,000 lb. per year of acrylic fiber.

B. F. GOODRICH AND ALGEMENE, Arnheim.
Project: Butadiene plant.

KETJEN CARBON, LTD. (Royal Sulphuric Acid Works), Rotterdam.
Construction: Facilities for production of

Another example of PROCON

CREATIVE CONSTRUCTION

This new 800 T/D Platformer built for Deutsche Shell at Hamburg-Harburg, Germany, is typical of the many petroleum, petrochemical and chemical processing units for which Procon has been selected to handle construction.

Whether your plans call for additional process facilities or an entire new plant, Procon's world-wide organization can provide complete service from blueprint to finished job. Handled by Procon, your new facility will be built to perform efficiently, economically . . . and as intended.

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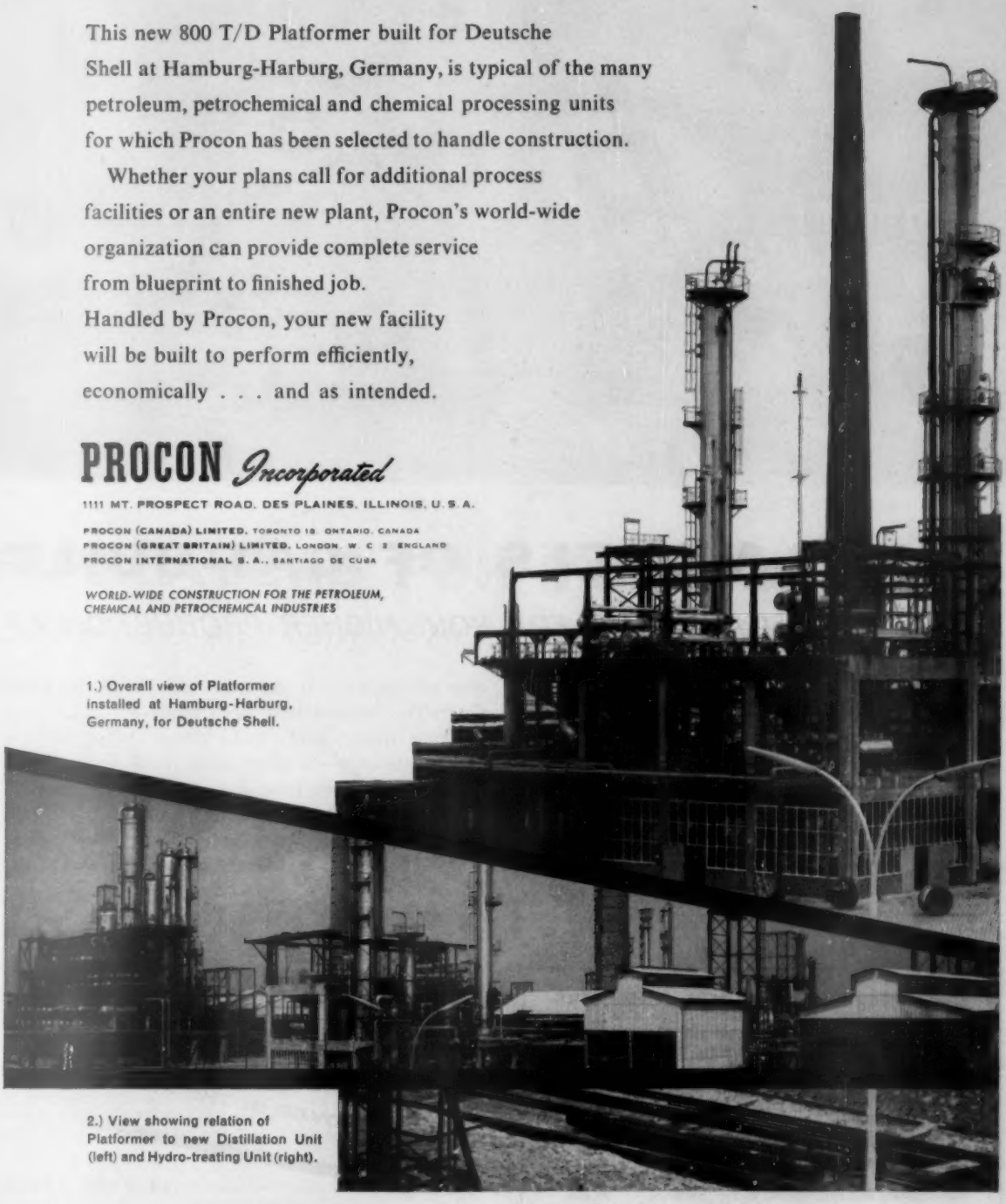
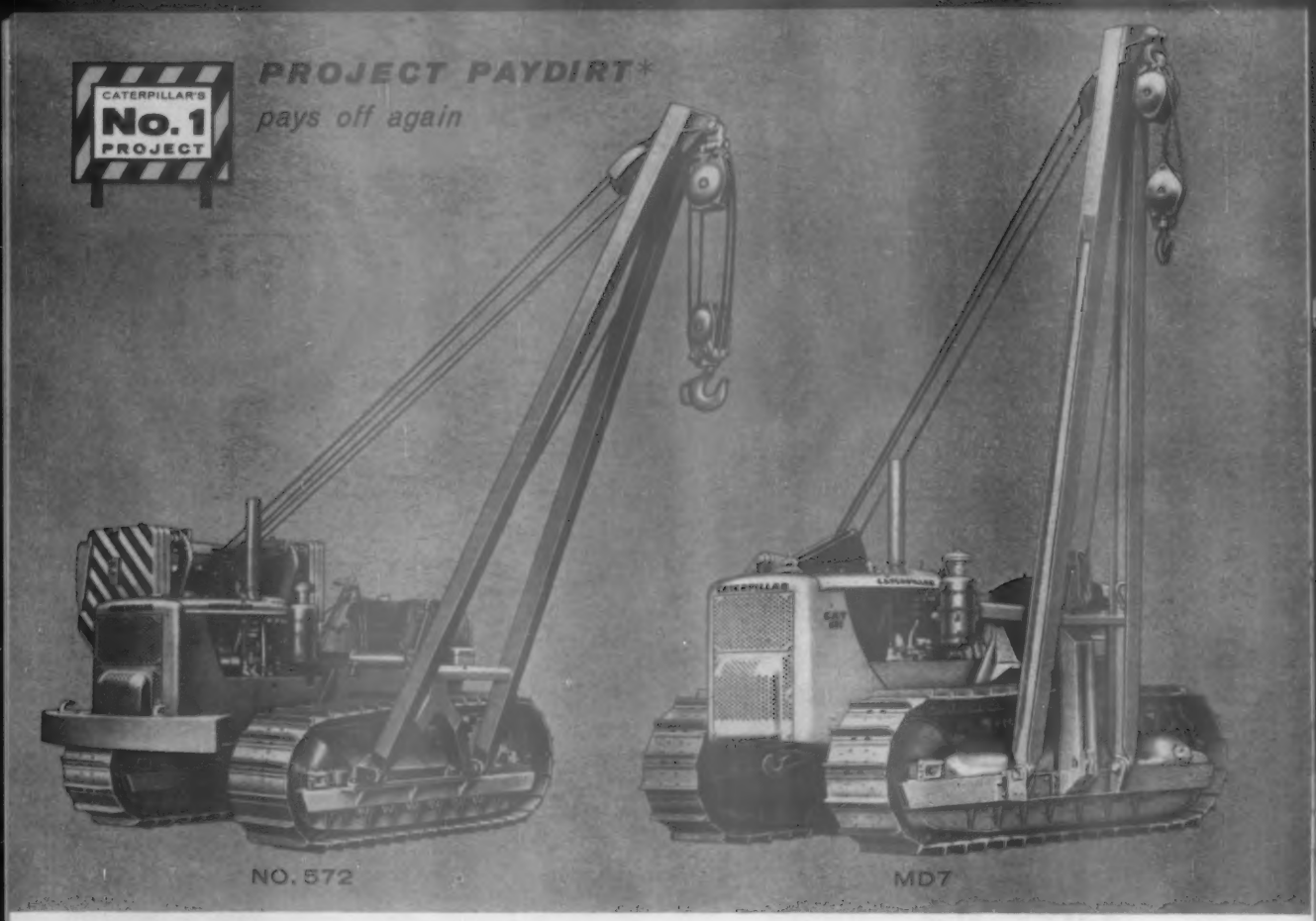
WORLD-WIDE CONSTRUCTION FOR THE PETROLEUM, CHEMICAL AND PETROCHEMICAL INDUSTRIES



1.) Overall view of Platformer installed at Hamburg-Harburg, Germany, for Deutsche Shell.

2.) View showing relation of Platformer to new Distillation Unit (left) and Hydro-treating Unit (right).



2 NEW MODELS OF CAT-BUILT

THE PAYOFF FOR YOU: HIGHER PRODUCTION AT

Here are two new models of Cat-built Pipelayers designed to deliver even greater production at lower operating cost than the models they're replacing. Designed specifically for pipeline work, they're built to pay off in performance that no other units in their class can match.

Caterpillar's Project Paydirt sparked the improvements that account for their superiority. Major improvements include a new turbocharged 140 HP Engine, new lifetime lubricated rollers and idlers and new dry-type air cleaner. At the same time, many job-tested Caterpillar features have been retained.

As a result, there's more power, longer life and less maintenance—in short, *more profit* for you!

Get the complete facts about the new machines from your Caterpillar Dealer. There's a spot for each in your spread. Ask him to demonstrate. Say when and where—he'll be there! (See the great new No. 583, D8 and D7, too!)

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

FAST FACTS ABOUT THE NEW PIPELAYERS

	No. 572 Series D	MD7 7-roller frame
Lifting capacity (4-ft. overhang), lb.	86,000	54,200
Turbocharged engine, horsepower at sea level	140	140
Drive	Torque converter	Direct, oil clutch
Ground clearance, in.	19	15½
Total extendable counterweight, lb. (approx.)	10,900	8,600
Approximate shipping weight, lb.	58,500	35,800

CATERPILLAR

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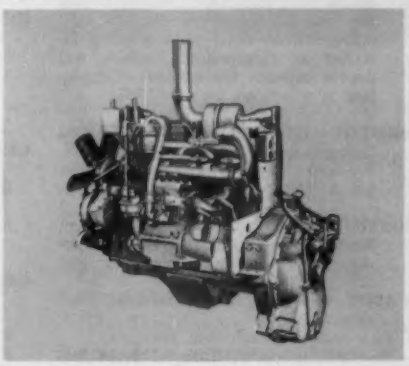
BORN OF RESEARCH
PROVED IN THE FIELD

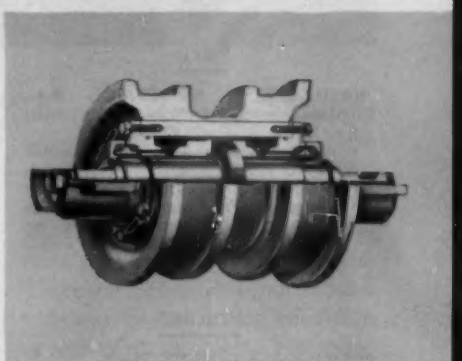
PIPELAYERS FOR YOUR SPREAD

LOWER COST AND LONGER LIFE, LESS MAINTENANCE!

NEW DRY-TYPE AIR CLEANER. Here's still another major Caterpillar research development on these machines — the new dry-type air cleaner which removes at least 99.8% of all dirt from intake air during every service hour. Filter element can be cleaned and re-used. Cleaner can be serviced in 5 minutes. Payoff: longer engine life, greater economy, less maintenance.



NEW TURBOCHARGED ENGINE. The horsepower of these modern, heavy-duty pipelayers is up from 128 to 140 at the flywheel, an increase of 9%. Since the turbocharger uses waste energy from the engine exhaust to pack more air into the cylinders, over-all efficiency and fuel economy are substantially increased. Another payoff: faster response to load changes.



NEW LIFETIME LUBRICATED ROLLERS AND IDLERS. That's right — lifetime! In a major research breakthrough, Caterpillar has achieved track and carrier rollers and idlers that never require further lubrication until rebuilding. On-the-job roller lubrication is eliminated. Over-all payoff: greater economy and less maintenance than with ordinary rollers and idlers.

* ***PROJECT PAYDIRT:*** Caterpillar's multimillion-dollar research program — to meet the continuing challenge of the greatest pipeline construction era in history with the most productive machines ever developed.

13,000 tons of carbon black per year for the rubber industry.

KUNSTZIJDE UNIE, N.V.
Project: Styrene plant.

NETHERLANDS STAATS MIJNEN.
Construction: Low and high-pressure polyethylene plants are being built.

ROYAL DUTCH-SHELL GROUP, Pernis (Rotterdam).
Raw material: Comes from adjacent refinery.
Principal products: Sulfur, synthetic detergents, polyvinyl chloride, resins, solvents, insecticides, alkyl chloride, epichlorhydrin, and synthetic glycerine.
Construction: New facilities for making styrene, butadiene, and synthetic rubber. Completion of the 50,000-ton per year plant is scheduled for 1960.

Pakistan

BURMAH OIL CO. and CONSTOCK INTERNATIONAL METHANE, LTD.
Project: Preliminary talks on possibility of setting up a carbon-black plant in West Pakistan have been held by the above companies. Raw material would be gas from Sui field produced by Pakistan Petroleum, Ltd., a Burmah Oil subsidiary.

PAKISTAN INDUSTRIAL DEVELOPMENT CORP., Multan, West Pakistan.
Construction: Fertilizer plant to produce 103,000 tons per year of ammonium nitrate and 59,200 tons of urea scheduled to open late in 1960. Natural gas from Sui field will be used.

PAKISTAN INDUSTRIAL DEVELOPMENT CORP., Fenchuganj, East Pakistan.
Construction: Fertilizer plant expected to open in 1961. Natural gas from Sylhet field will be raw material.

Peru

FERTILIZANTES SINTETICOS, S.A., Callao (seaport for Lima).
Raw material: Fuel oil.
Principal products: Anhydrous ammonia (20,000 metric tons), ammonium sulfate fertilizer (7,500 tons), ammonium nitrate—fertilizer and technical grades (35,000 tons), nitric acid—98% by weight (1,500 tons), and nitric acid—53% by weight (54,000 tons).

Poland

POLISH GOVERNMENT, Plock
Construction: A petrochemical plant will be part of new refinery project. Work on refinery is to start next year, with completion reportedly scheduled for 1965. Petrochemical plant would use newly discovered natural-gas supplies. A Polish delegation has discussed possibility of purchase of equipment with Italian Government. Synthetic rubber is expected to be produced at rate of 60,000 tons per year by 1965. Poland already has contracted to deliver tires to Finland, Yugoslavia, and Turkey.

Portugal

SOCIEDADA PORTUGUESA DE PETROQUIMICA SARL, Lisbon.
Project: Ammonia plant, with capacity of 185 tons daily.

Spain

CEPSA, Las Palmas, Canary Islands.
Construction: New plant, with capacity of 90 tons of ammonia and 365 tons of ammonium sulfate per day. Scheduled for completion by mid-1960. Raw material will be refinery gas.

INI, Puertollana.
Project: Low-pressure polyethylene plant is planned.

Trinidad

FEDERATION CHEMICALS, LTD. (associated with W. R. Grace & Co.), at Point Lisas near Pointe-a-Pierre.
Construction: Synthetic anhydrous ammonia plant, using hydrogen from locally produced natural gas. Products will include nitrogen, ammonium sulfate, urea, and sulfuric acid.

Union of South Africa

AFRICAN EXPLOSIVES AND CHEMICAL INDUSTRIES (subsidiary of Imperial Chemical Industries), Johannesburg.
Project: Facilities for making methanol, formaldehyde, and ureaformaldehyde resins.

PHILLIPS CARBON BLACK CO. (owned jointly by Phillips Petroleum Co. and Industrial Development Corp. of South Africa, Ltd.).
Project: Carbon-black plant with capacity of 22,000,000 lb. per year. Plant is expected to go on stream by the spring of 1961.

USSR

RUSSIAN GOVERNMENT.
Project: Russia is buying a $6-million chemical plant in England from Petrochemical Engineering Co. and Vickers-Armstrong (Engineers). The plant will be delivered by the end of 1960.
(Last year the Soviet Government announced plans to push construction and expansion of petrochemical plants.)

United Kingdom

BRITISH CELANESE CO., LTD., Spondon, Derby, England.
Raw material: From thermal cracking process.
Principal products: Ethanol for acetic acid and isopropanol acetone.

BRITISH HYDROCARBON CHEMICALS, LTD. (owned 50% by British Petroleum Co., Ltd., and 50% by Distillers Co., Ltd.), Grangemouth, Scotland.
Raw material: Naphtha.
Principal products: Ethylene, ethanol, diethyl ether, polyethylene, propylene, isopropanol, cumene, acetone, tetrapropylene, and butadiene. Cumene is used for manufacture of phenols.
Construction: A third plant is being installed at Grangemouth, which will double capacity for ethylene. Completion is scheduled for mid-1960.

BRITISH PETROLEUM CO., LTD., Grangemouth Refinery, Grangemouth, Scotland, sulfur from refinery sour gas.

BRITISH PETROLEUM CO., LTD., Kent Refinery, Kent, England, 45 tons per day of sulfur from refinery sour gas.

CABOT CARBON, LTD., Stanlow, Cheshire.
Raw material: Petroleum fractions.
Principal products: Carbon blacks (capacity 55,000 tons per year in seven grades).

CHEMSTRAND, LTD., Coleraine, Northern Ireland.
Product: Acrilan acrylic fiber.

ESSO PETROLEUM CO., LTD., Fawley, Hants, England.
Raw material: Petroleum fractions.
Principal products: Ethylene (40,000 tons per year), which will go to nearby plants of Monsanto Chemical Co. and Union Carbide; butadiene (42,000 tons); propylenes (25,000 tons); pentenes (18,000 tons); and sulfur. Production of latter to be raised to 28,000 tons per year.

FORTH CHEMICALS, LTD. (British Hydrocarbon Chemicals, Ltd., and Monsanto Chemical Co., Ltd.), Grangemouth, Scotland.
Raw material: From British Hydrocarbon Chemicals.
Principal products: Styrene polymer, ethyl and diethyl benzene, polyethyl benzenes, and toluene.

GEMEC, LTD. (Union Carbide, Ltd.), Fawley, Hants, England.
Construction: Plant for production of ethylene oxide and derivatives is due for completion. Ethylene will be purchased from Esso's Fawley plant.

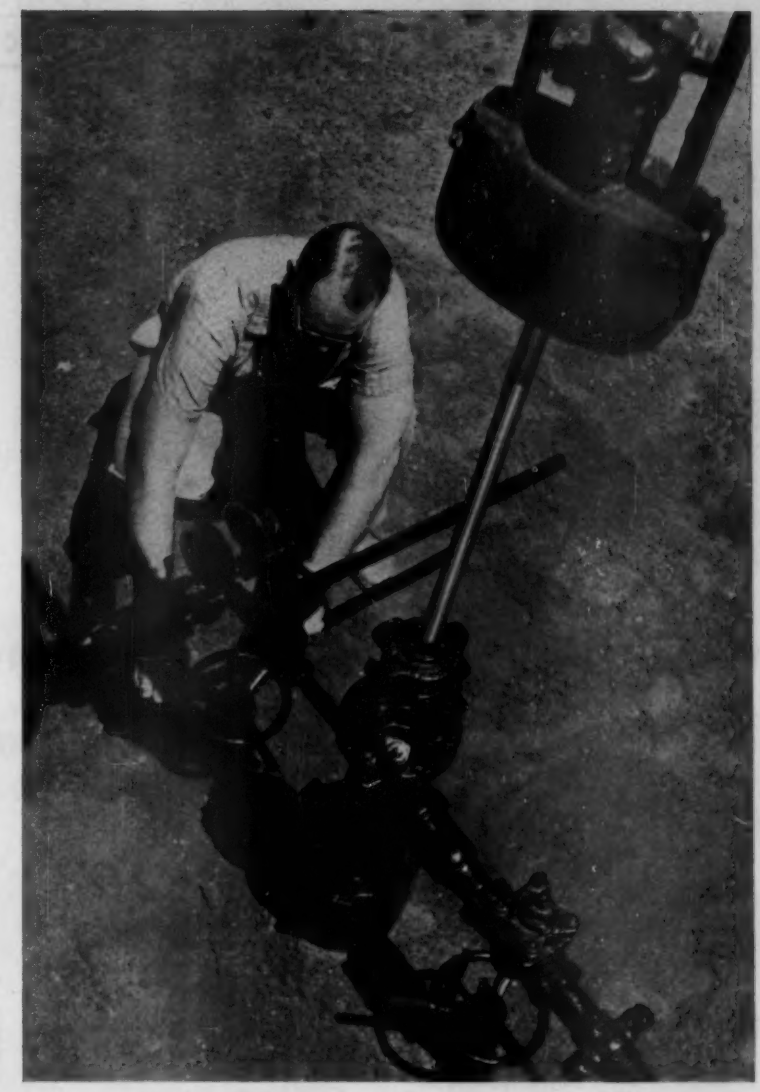
GEMEC, LTD. (Union Carbide, Ltd.), Grangemouth, Scotland.
Raw material: Ethylene from British Hydrocarbon Chemicals.
Principal products: High-pressure polyethylenes (11,500 tons per year).

GRANGE CHEMICALS, LTD. (British Hydrocarbon Chemicals, Ltd., and Oronite, Ltd.) Grangemouth, Scotland.
Raw material: Tetrapropylene.
Principal products: Dodecyl benzene for manufacture of high-grade synthetic detergents.

IMPERIAL CHEMICAL INDUSTRIES, LTD., Billingham, England.
Principal product: Anhydrous ammonia (60,000 tons per year).

IMPERIAL CHEMICAL INDUSTRIES, LTD., Severnside Site, England.
Construction: Long-term plans have been announced for a large complex of plants to be built on a site near

Over two years for X2 rods in the Gov't. Marye No. 1



A 4,800-ft string of ¾-in. Bethlehem X2 carbon-manganese sucker rods is now in its third year of service in the Gov't. Marye No. 1 Well, in the Bisti Field near Farmington, New Mexico.

The Gov't. Marye No. 1 is operated by The British American Oil Producing Company. It is equipped with a Bethlehem 114D-14SP-54 pumping unit, which operates at 20 spm, using a 54-in. stroke. The well produces 280 bpd of 37.8-gravity oil. Production is currently from 4,800 ft, from the Gallup formation.

The Bethlehem X2 rod is ideal for medium pumping duty in non-corrosive wells, as well as in wells which are effectively inhibited. It is made from top-quality carbon-manganese steel, and is carefully normalized to provide uniform mechanical properties.

In addition to the X2 rod, we produce three grades of alloy steel rods, plus a full line of accessories. There's a Bethlehem rod to meet virtually any pumping condition or corrosion problem. For complete information, just get in touch with your nearby Bethlehem distributor.

Bethlehem Rod Package Handles Easily

Bethlehem Sucker Rods come securely bundled in unit package which is easy to handle. Package contains 80 or 100 rods. Rods rest on grooved spacers which prevent individual rod movement, protect rods against damage. Special wrench can be furnished for opening bundle.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

Export distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

Avonmouth. Operations will be mainly based on products from cracking petroleum. An expenditure of $282 million is envisaged by the mid-1970's.

IMPERIAL CHEMICAL INDUSTRIES, LTD., Wilton, England.
Principal products: C_2, C_3, and C_4 hydrocarbons, mainly ethylene and propylene, for which capacity during 1959 will exceed 180,000 tons per year; ethylene for polyethylene (55,000 tons per year, increasing to 90,000 tons in 1960); ethylene oxide for detergents, with alkylated phenols; ethylene glycol (16,000 tons per year capacity) for explosives, and with p-xylene for dimethyl terephthalate-based polyester fiber and transparent polyester film; tail gas (methane) for hydrogen cyanide manufacture as intermediate for methacrylates, and with acetone, acrylic plastic; propylene for normal and isobutanols by carbonylation (Oxo process), and for isopropanol, acetone, and polypropylene; butylene for alkylated phenols; and butadiene for specialty copolymer rubbers. (Butyl alcohols are included in a plan for a significant expansion in plasticizer alcohols productive capacity.)
Construction: New projects include a 30,000,000-lb. per year expansion of the terephthalic acid plant to be completed in 1960. This will double output of the acid used in production of polyester fiber and polyester film. Earlier in 1959, Imperial announced plans to build a plant for manufacture of polyester film near Dumfries, Scotland. Eventual capacity will be 2,000 tons per year or more.

INTERNATIONAL SYNTHETIC RUBBER CO., LTD., Fawley, Hants, England.
Raw materials: Butadiene and styrene.
Principal products: Synthetic rubbers (capacity 50,000 tons per year).

MONSANTO CHEMICAL CO., LTD., Fawley, Hants, England.
Raw material: Ethylene.
Principal products: Polyethylenes (capacity 10,000 tons per year).
Construction: Plant being expanded.

PETROCHEMICALS, LTD. (Shell Chemical Co., Ltd.), Carrington, Lancs, England.
Raw material: Naphtha.
Principal products: Ethylene, propylene, ethylene oxide, polyethylenes, propylene oxide, benzene, toluene, xylenes, styrene copolymers, styrene monomer, isopropanol, glycol ethers, ethylene glycols, ethanolamines, polyethylene glycols, propylene glycols, propanolamine, polypropylene glycols, ethylene oxide condensates, phenols, cresols, alcohols, isopropanolamines, ethylene glycol ethers, and octyl phenol condensates.
Construction: New plant is being installed to increase production of ethylene oxide from 25,000 tons to 45,000 tons per year. A new plant is being built for production of styrene monomer. The company also plans to build a 30,000-ton per year plant for production of polyethylene and polypropylene.

PHILBLACK, LTD., Bristol, England.
Raw material: Petroleum fractions.
Principal products: Carbon blacks of all grades.

SCOTTISH OILS, LTD., Pumpherston Refinery, Pumpherston, Midlothian Scotland
Raw material: Petroleum extracts.
Products: Detergents.

SHELL CHEMICAL CO., LTD., Shellhaven, Essex, England.
Raw material: Refinery gases.
Principal products: Dodecyl benzene for the manufacture of detergents (30,000 tons per year) anhydrous ammonia (75,000 tons per year) for the manufacture of fertilizer and elemental sulfur.

SHELL CHEMICAL CO., LTD., Stanlow Refinery, Stanlow, Cheshire, England.
Raw material: Refinery gases.
Principal products: Some of the olefins produced are sold to manufacturers for further processing, others are used in the Stanlow plant for manufacture of products. These include resins, solvents (40,000 tons per year), elemental sulfur, naphthenic acids, naphthenic sulfonates, and detergent.

STYRENE PRODUCTS, LTD., (Shell Chemical Co., Ltd.), Carrington, Lancs, England.
Principal products: Polystyrene molding powders to customer specifications.

UNION CARBIDE, LTD., Grangemouth, Scotland.
Construction: Plant designed to produce 30,000,000 lb. of polyethylenes per year.

Uruguay

ADMINISTRATION NATIONAL DE COMBUSTIBLES ALCOHOL Y PORTLAND, Montevideo.
Construction: Sulfur plant.

Venezuela

INSTITUTO VENEZOLANO DE PETROQUIMICA, Moron.
Construction: Facilities partly constructed for ammonia, ammonia products, et cetera.

NEGROVEN, Moron.
Construction: A $2.4-million carbon-black plant is scheduled for completion in July 1960. Capacity will be 20,000,000 lb. yearly. Licensing agreement has been made with United Carbon Co., Inc.

Yugoslavia

RUDNAP (Yugoslav company) Lukavaz, Bosnia.
Construction: Agreement signed between Rudnap and Montecatini and Ansaldo (Italian companies) for construction of an $8-million nitrogen-fertilizer plant. The new unit would turn out 100 metric tons of anhydrous ammonia per day, 340 tons of nitric acid, and 380 tons of calcium nitrate.

Reprints Available

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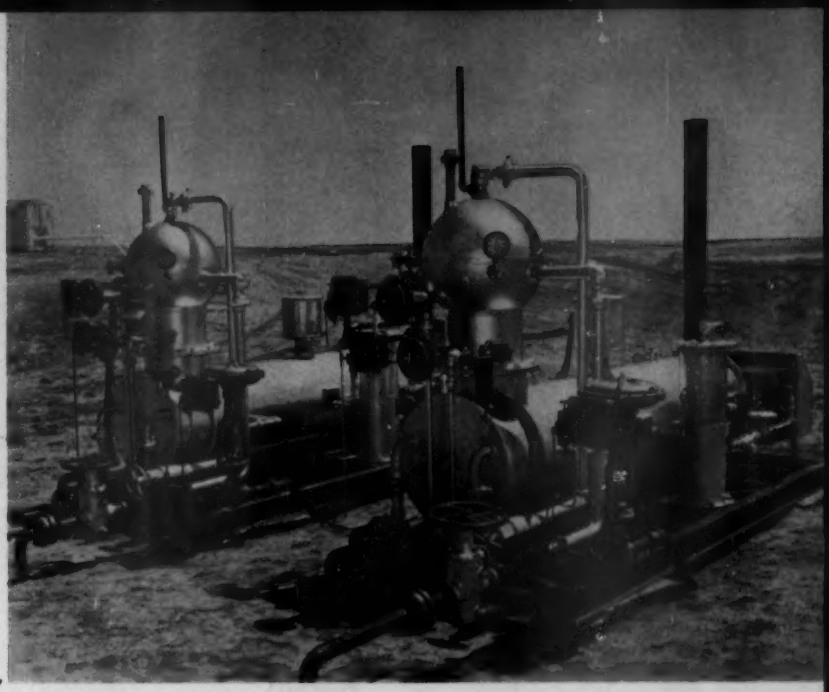
ETHYLENE PLANT of Petroleum Chemical, Inc., Lake Charles, La., is one of industry's newest.

These two BS&B FREE-O-FREEZ Units are typical of many going into cold weather areas.



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For Freedom From Freeze-Ups!

FREE-O-FREEZ by BS&B is a packaged Heater-Separator requiring minimum hookup and specifically designed for cold weather operation . . . gives dependable, trouble-free service . . . even in the dead of winter!

FREE-O-FREEZ is a neat, compact, integrated unit . . . combines the field-proved advantages of spherical separation and indirect heating to provide efficient water-oil separation and release of solution gas.

Prior to choking, the wellstream is heated in the heater flow coil to prevent freeze-up and hydrate formation. The water-oil separator section of the spherical separator is immersed in the water bath of the heater where it absorbs heat to prevent freeze-up. Flash arrestors are provided for safety.

FREE-O-FREEZ is available in a wide range of heater sizes, coil ratings and spherical separator sizes . . . and with a large selection of heater and separator accessories . . . to satisfy a variety of lease conditions. Simple, rugged and accurate controls are used.

A call to your BS&B Man will bring you detailed information on the unit best suited to your requirements. Or, you may write to . . .

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ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

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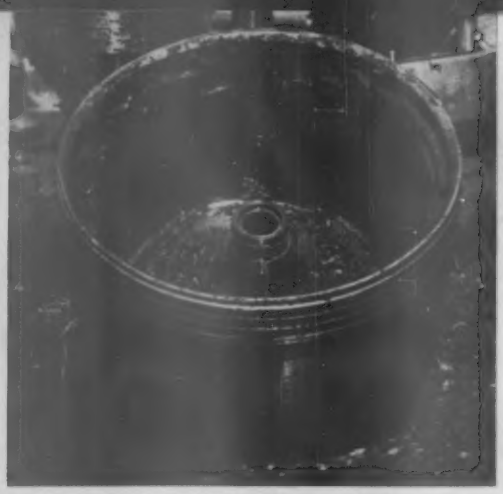

BATCH-TYPE CENTRIFUGE, skid-mounted for field testing, left, and above, bowl of a batch-type centrifuge after testing, showing paraffin deposition. Disk stack is in background.

Centrifuges pass tests as separators

Shell Oil Co. has tested centrifuges both in the laboratory and in the field to determine if the machines are practical for replacing the conventional heater-treater in removing produced water from crude oil on the lease. Success of these tests indicates that there may indeed be a good place for electrically driven centrifuges on leases where gas is expensive or not available, where space is at a premium as on offshore platforms, or where more than a normal fire hazard exists.

By **M. J. SERGESKETTER**
Mechanical Engineer, Shell Oil Co.
Lafayette, La.

RESULTS of Shell Oil Co.'s field and laboratory tests lead to several conclusions about use of centrifugal dehydrators for separating crude oil and produced water:

- Oil and formation water can be separated satisfactorily (to less than 0.5% b.s. and w. in oil) without heating if chemical is added where needed.
- Amount of chemical needed varies, but is likely less than now required with the standard heating and settling process of separation.
- Based on a cost of 20 cents per M.c.f. of gas, a 1,000-bbl. per day centrifugal dehydrator could operate more cheaply than a comparable heater-treater.

The Shell tests covered four machines: two laboratory-scale models, a full-scale batch-type machine, and a full-scale continuous self-cleaning machine. On these particular machines, these conclusions were drawn:

1. Treating rate depends on the percentage of formation water in the feed stream. The full-scale units effectively treated 1,000 bbl. per day of total liquids with oil rates of 600 bbl. per day.

2. Separation efficiency of the laboratory-size machines and the full-scale self-cleaning machine appeared to be unaffected by the water content of the treated stream. However, on the full-scale batch unit, b.s. and w. content of the treated oil rose when the inlet stream's water content exceeded 75 to 80%.

3. Gravity of the oil had no noticeable effect on the units, provided chemical was added when needed.

4. The full-scale batch machine needed only 3 hp. for operation. The self-cleaning machine of the same capacity required 20 hp.

5. The batch-type centrifuge appears to have application in fields producing paraffin-free and sand-free oil. However, during field tests in the Iowa, Louisiana field, paraffin and sand buildup in the bowl plugged the unit in as little as 2 hours.

6. During more than a month of field testing, the full-scale self-cleaning machine gave encouraging results. At throughput rates of about 1,000 bbl. of total liquids, oil was cleaned to 0.1 to 0.2% b.s. and w.

Space, gas getting dear . . . Centrifuges were first tried for separation of crude oil and formation water some 30 years ago in a limited way. The centrifuge lost out quickly when the modern emulsion heater-treater came in. The fired treater had no moving parts and used natural gas which was produced with the oil and which was then quite cheap.

The fired heater-treater has been satisfactory in most respects but does cause problems in some places such as offshore platforms. The space occupied by a treater on a platform is expensive. Moreover, gas has become expensive and there is always some danger of fires with a heater-treater. These facts combine to make a compact, unfired, electrically driven centrifugal dehydrator attractive once more.

Because there were no data available on separating oil-water emulsions with centrifuges in the field, pilot tests were run on two laboratory-scale machines. The first was a model which basically consists of a hollow

19,000 B/D COKER ON STREAM FOR MOBIL OIL CO.*

*A Division of Socony Mobil Oil Company, Inc.

unit feeds mixture of 7 stocks including Furfural Extract, Duosol Tar and Propane Deasphalting Tar

The new 19,000 B/D Delayed Coking Unit – designed, engineered and constructed by The Lummus Company for Mobil Oil Company at their Paulsboro, New Jersey refinery – is on its initial run.

The coker, comprising 4 coke drums 19 feet in diameter by 63 feet tangent to tangent, is designed for 764 tons per day of coke, making it the largest initial capacity coker ever built in the United States.

The feedstocks are various reduced crudes or blends of residua whose gravity varies from 3 to 14° A.P.I. These charge stocks may be blended with up to 25% of furfural extract.

The unit cokes the heavy residual stocks withdrawn from other refinery units which previously were blended into fuel oil. The coker makes seven products: fuel gas, butane-butylenes, light and heavy gasolines, light and heavy gas oils, and coke.

In addition to the coking section, the unit includes: a gas recovery section, sulfuric acid treater for gasoline, amine treater for light hydrocarbons, and a caustic treater for the butane-butylene stream.

* * *

The Mobil Oil Coker is the 13th delayed coking unit engineered and constructed by Lummus. Lummus has built over 40% of the total delayed coking capacity erected in the last 10 years in the U.S.

When you plan a new unit – or a complete refinery – Lummus can put over 50 years of experience, on more than 800 plants throughout the world. to work for you.

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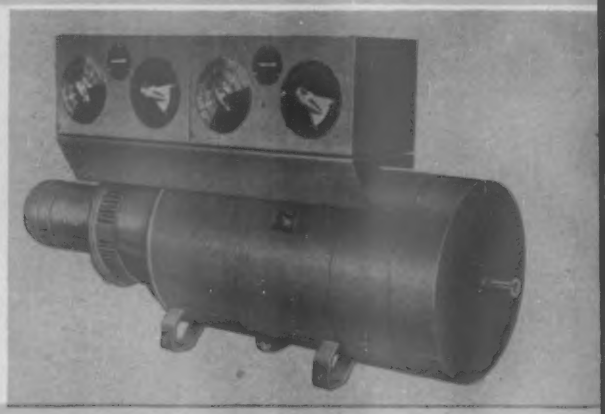
engine power
BY CATERPILLAR

A new twin arc-welder that costs less, weighs less, takes up less space

Powered by the Cat D311 (Series H) Engine the new, compact Twin Arc-Welder has ample power and capacity to handle two 300-amp. arcs. It costs less and has faster recovery. Operators know it has hot arc on contact with no waiting for the machine to come up to speed. Operation is smoothly uniform and control is completely automatic.



Reliable Cat power drives twin Lincoln welding generators and features two independent control panels permitting different welding operations at the same time. The single unit, two-arc package is only 35 inches wide to permit placing two side by side on the average truck bed—enough power to supply four men.

By powering this new electric arc welder with a D311 (Series H) Engine, Caterpillar has improved on the performance of the D315 powered welder. It's 1,300 pounds lighter, 20 inches shorter, 3½ inches lower and 4½ inches narrower—a lighter, more compact, more transportable unit that can meet the most exacting pipeline schedules and the toughest terrain. Big news, too, is its lower purchase price.

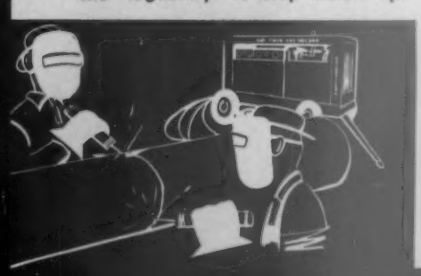
The new Cat Twin Arc-Welder combines two welding generators in one frame with dependable Caterpillar 4-cycle power. Dimensions above are for the skid base arrangement with base type fuel tank. Also available is four-wheel, heavy-duty running gear with springs and parking brake.

THESE FEATURES MEAN PROFITABLE WELDING FOR YOU:

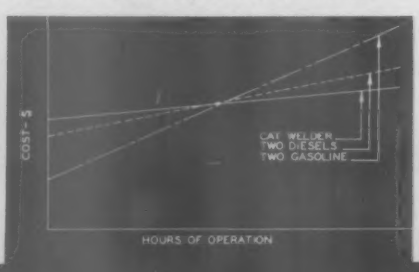
1. Simultaneous operation of two arcs with the two 300-amp. Lincoln welding generators powered by the Cat D311.
2. Independent generator controls allow welding at different voltages and amperages or polarity at the same time.
3. 600 amp. for automatic welding available by a simple connection change.
4. The Cat D311 Diesel can use a wide range of readily available fuels including low-cost grades.
5. Ample power for four welders (two Twin Arc-Welders) easily transported on one small truck.
6. Large capacity 3 KW exciter provides extra power for auxiliary tools.

Engine Division, Caterpillar Tractor Co., Peoria, Ill., U.S.A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

NO FREEZING even when two rods work at capacity. Cat Diesels have the "lugability" to keep current up.



LOWER OPERATING INVESTMENT over life of a welding unit is important. A Twin Arc-Welder saves money over other makes.



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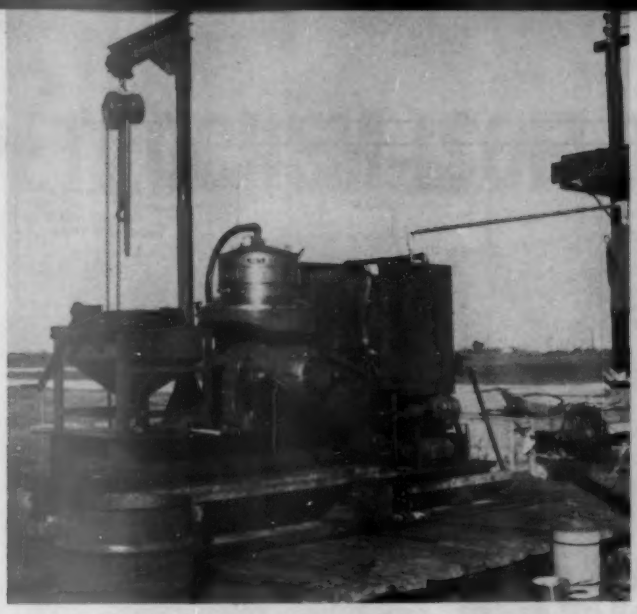


SELF-CLEANING-TYPE centrifuge, set up for field testing.

DISK STACK of a self-cleaning-type centrifuge.

cylinder rotating in a vertical position about its axis. The fluid stream enters the bottom of the cylinder and leaves at the top. The heavier phase, water, is thrown by centrifugal force to the outside wall and the lighter phase, oil, is displaced toward the center.

The oil-water interface is controlled by a ring dam which maintains a certain oil depth and water depth for the particular specific gravities of the fluids. This ring dam can be adjusted to control position of the interface.

This machine was tested in the Iowa, Louisiana, field using crude from several wells and also combined production from a tank battery. Fluids ranged from oil with 0.7% b.s. and w. to water with 0.6% oil. The tests showed that the machine could yield clean oil but that its capacity would vary with the per cent of water in the oil. Also, it was necessary to add chemical to obtain satisfactory separation in many cases.

The second laboratory-scale machine was a model in which the water level is maintained by a pressure differential between the fluid inlet and the oil discharge. This pressure-differential method permits easy adjustment of the interface but makes the machine sensitive to pressure changes on the inlet or discharge. Such pressure changes might result in oil or water carryover.

Samples tested in the laboratory ranged from 20 to 85% b.s. and w. Results were satisfactory.

Full-scale field tests . . . First full-scale centrifuge to be tested in the field was a batch-type machine in which the oil-water interface is controlled by back pressure. In this unit, the interface is positioned by holding the correct ratio of back pressures on the oil and water outlet streams.

Fluctuating feed rates cause some difficulty in maintaining the proper ratio of back pressure. This centrifuge uses a 60-psi. pressure drop through the unit to reduce the horsepower required to operate.

Maximum working pressure of the unit is 100 psi.; so, a unit could be designed to discharge oil with enough pressure to flow to stock tanks.

This machine was tested in Iowa field using a combined stream from 25°-API-gravity oil wells, from 30°-API-gravity oil wells, and from weathered oil skimmed from a disposal pit. The feed stream varied from 1 to 90% b.s. and w. Feed rates varied from 200 to 800 bbl. per day of total fluid. In most cases the oil discharged was satisfactory.

In no case was there any visible oil in the water discharge. However, there was serious solids buildup of sand and paraffin in the unit.

Self-cleaning machine excels . . . Tests were then run on a self-cleaning centrifuge to determine if the unit could separate crude-oil and water emulsions containing sand and paraffin. This machine maintains the proper oil-water interface by means of a fixed ring dam, thus controlling the interface regardless of surging feeds. The unit separates oil, water, and solids. The water and solids are discharged together and a recycle stream is pumped through the machine to continually wash the solids from the bowl.

In Iowa field, the unit satisfactorily separated water from the feed stream to yield a discharge oil containing only 0.1 to 0.2% b.s. and w. It also satisfactorily separated sand and paraffin from the stream.

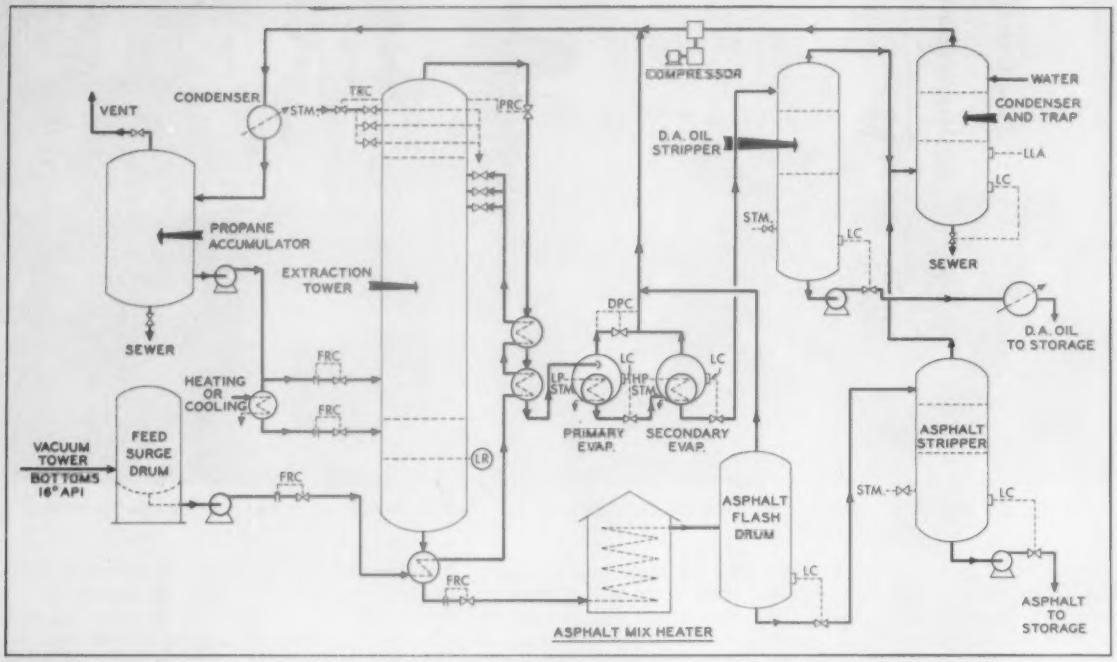
As a result of the tests on this machine, it appears that it will be suitable for dehydration of crude oil in the field. There were difficulties during the test period with auxiliary equipment. These difficulties prevented a long-term test to determine exactly how long the machine itself could operate without shutdown for cleaning. Time required to disassemble, clean, and reassemble this machine is about 4 hours.

How they compare . . . All of the emulsion samples tested fell in the temperature range from 70° to 100° F. Because of the equipment hookup and because of the well-production rates, the full-scale machines could not be tested at high enough rates to determine maximum throughput possible with low-water-content emulsions.

In comparing the operating costs of the centrifuges to those of a conventional heater-treater, cost of gas was placed at 20 cents per M.c.f. And, it was estimated that a heater-treater rated at 0.5 M.M.B.t.u. per hour (a 6 by 27.5-ft. model handling 300 to 1,200 bbl. of oil and 500 to 4,500 bbl. of water per day) would burn 17 M.c.f.d. of gas with a heat capacity of 1,000 B.t.u. per cu. ft. and 70% firebox efficiency.

Cost of operating the centrifuges was placed at the equivalent of 15 cu. ft. of gas per horsepower-hour. Thus, in handling about the same volume of fluid per day, the costs might run about like this:

	Per day
0.5-M.M.B.t.u. per hour heater-treater	$3.40
3-hp. batch-type centrifuge	0.20
20-hp. self-cleaning centrifuge	1.44



FLOW THROUGH THE APCO UNIT is indicated in this simplified flowsheet. The unit is quite flexible in ability to make a range of asphalt penetrations. Normally it can be operated to make within five numbers of desired penetration. Fig. 1.

How Anderson-Prichard uses 3,000-bbl. per day propane unit for making high-quality asphalt

- A payout was assured when based on additional cat cracker charge, improved quality of this charge, and elimination of 250 bbl. per day of No. 6 fuel oil.

PLANS were made by Anderson-Prichard early in 1957 to design and construct a new crude-distillation unit. This unit was to be basically a conventional three-tower system with 25,000 bbl. per day capacity, or an increase of approximately 35% over the old unit. Part of the existing equipment was a 10-ft.-diameter vacuum tower that further reduced the crude bottoms to cat cracker charge and asphalt product for sales. This tower was to be retained for use with the new crude unit.

The crude oil processed in this plant is a 42°-gravity mixed stream of Oklahoma and Kansas crudes containing 4.0% of 100 penetration asphalt. For some time the vacuum tower had been too small for a crude operation of 18,500 bbl. per day and the products were not entirely satisfactory.

It was necessary to carry 825° F. transfer temperature with a vacuum of 28 in. Hg, followed by a small amount of oxidation, to produce a 200-penetration asphalt of borderline ductility and Oliensis spot test. Further reduction proved detrimental to the cat cracker gas-oil charge as far as Conradson carbon content from entrainment was concerned, and the asphalt failed the spot-test and ductility requirements.

After certain improvements were made in vacuum-tower operation, the 3,000-bbl. per day propane-deasphalting unit was installed. Design engineering and partial procurement on this unit were by Badger Manufacturing Co., with construction by Anderson-Prichard.

BY L. R. REINKEMEYER
Anderson-Prichard Oil Corp.,
Arkansas City, Kans.

The author is plant engineer with Anderson-Prichard Oil Corp. at the Arkansas City, Kans., refinery. He worked as a process engineer for Kanotex Refining Co. until 1953 when this company was purchased by Anderson-Prichard. He then spent 2 years at the Colorado City refinery with the Col-Tex Refining Co. before coming back to Arkansas City in his present position. Reinkemeyer has a degree in petroleum engineering obtained from University of Tulsa in 1950.

Paper presented at Western Petroleum Refiners Association meeting at Wichita, Kans.

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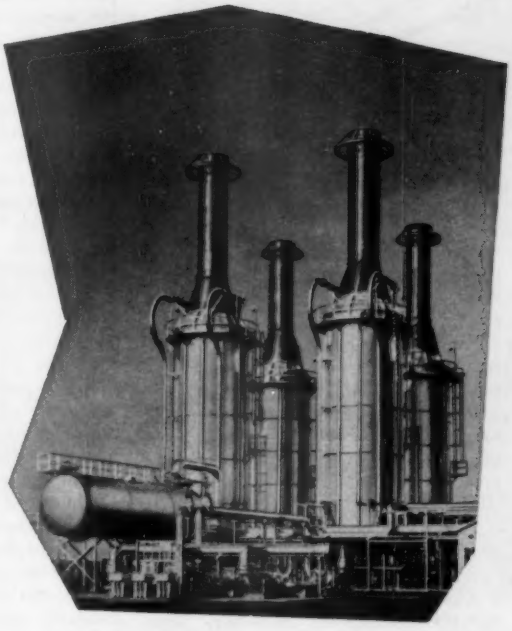

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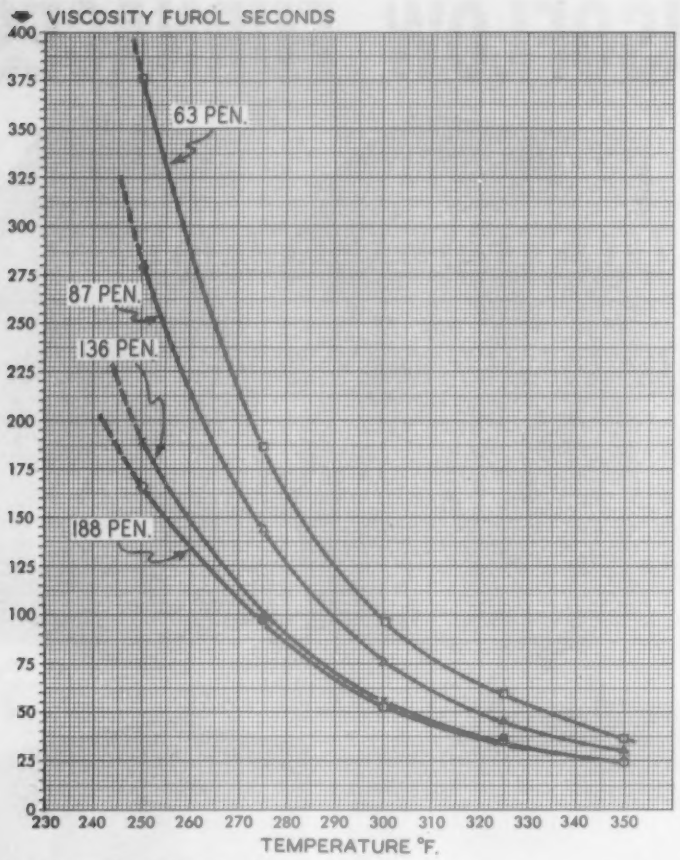


VISCOSITY-TEMPERATURE relation on asphalt from the Arkansas City propane deasphalting unit. Fig. 2.

First step . . . The most logical step, at first, was to do everything possible to improve the vacuum-tower operation. We did just that, and we feel that all possibilities of improvement were pretty well exhausted in time.

Tower internals were revamped three different times. This included installation of special low-pressure drop trays and other internal changes. Changes were made on the feed inlet. A slop-wax system with wire-mesh packing and a gas-oil wash system were installed. Cores were added to the heater tubes to reduce residence time, and numerous combinations of transfer temperatures, flows, steam rates, and pressures were all tried.

Still, carbon in the cat cracker charge remained high, and asphalt spot tests were borderline. The penetration was higher than desired with corresponding loss of gas-oil charge stock, and 250 bbl. per day of slop-wax cut was degraded from the cat cracker charge to No. 6 fuel oil.

Propane Extraction Enters the Picture

With plans for increasing the crude capacity by 35%, it was apparent that another vacuum unit, or some other means of reduction, would be needed properly to prepare the cat cracker feed and make a good asphalt for sales. Since our experience with the vacuum tower, even at reduced rates, was not satisfactory, propane extraction entered the picture. Further research made this type of reduction more attractive to us, and management decided that this was a proper means of solving all our related problems.

Propane deasphalting is not a new process by any means. It has been used for many years in preparing cat cracker feeds and bright stocks for lube-oil production. However, little attention was paid to the bottoms product. There was some question about the grade of asphalt that could be produced and whether the penetration could be controlled properly to make the different specifications of asphalts needed. With these questions in mind, some of the larger design and construction companies were contacted to explore the feasibility and payout of a 3,000-bbl. per day unit.

A payout was assured when based on just the additional cat cracker charge, improved quality of this charge, and elimination of the 250 bbl. per day of No. 6 fuel. Improved quality would result from lower carbon residues and metals in the total cat feed. In turn this would reduce coke and dry-gas production for increased profits.

An agreement was finally made with Badger Manufacturing Co., of Cambridge, Mass., to design and procure all necessary equipment for the unit. There was a fixed-fee agreement for this work and an understanding that we might do the actual construction ourselves. The work included complete process design, mechanical design, job specifications, and purchasing of major equipment. Requisitions were furnished for all remaining equipment that Anderson-Prichard elected to purchase directly.

Badger based all of its process design upon a complete pilot-plant study that was conducted by Esso Research & Engineering Co. An arrangement was made with Esso Research for a paid-up license agreement and Esso processed a large sample of the proposed charge stock from the bottom of the vacuum tower.

Esso made the results of the study and all of its asphalt-separation-process know-how available to Badger and furnished us samples of the asphalt bottoms and gas oil.

When the design and procurement were all complete, Badger proposed an additional fee for construction. After some deliberation, Anderson-Prichard chose to build the unit with plant-maintenance personnel. The work was not actually started until all the equipment was on the job site. Construction was then completed in less than 10 weeks. Particular attention was paid to the steam tracing of lines and all instrumentation and to proper design of flush and circulating lines, because of the heavy viscous oils to be handled.

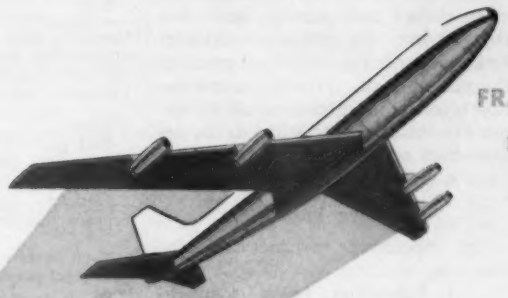
Total cost of the unit amounted to approximately $230 per barrel of charge for the 3,000-bbl. per day unit. Ordinarily costs would be somewhat higher; but cooling water was already available from an existing tower, saving this investment expense.

Propane Deasphalting

The process flow is essentially as shown on the simple diagram in Fig. 1.

The hot heavy-oil charge from the bottom of the existing vacuum tower is pumped by an eight-stage horizontal pump on flow control, through exchangers, to the extraction tower. The charge is a 16° API soft residue produced with only 735° F. vacuum-tower transfer temperature. The

LAMBERT FIELD / ST. LOUIS



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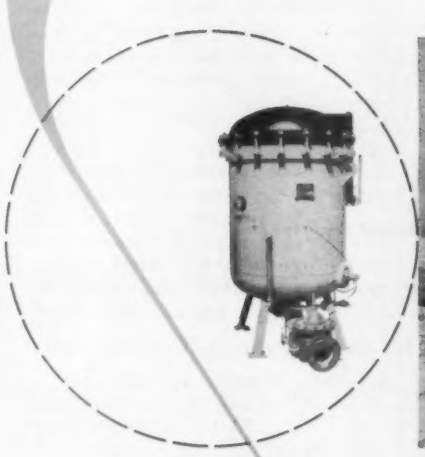
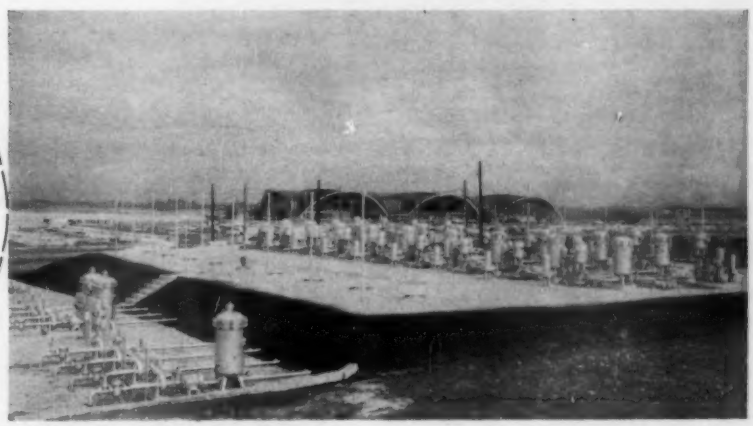
This fuel farm installation includes 21 Warner Lewis jet fuel separator/filters supplying fuel to the hydrant system at Lambert Field, St. Louis. The hydrant fueling carts are also equipped with Warner Lewis separator/filters. These units provide for highest efficiency in removal of water and solid contaminants at economical maintenance costs. These Warner Lewis separator/filters insure cleanest possible fuel for new turbo prop and turbo jet aircraft. For information on the complete line of separator/filters for mobile and stationery installations write Warner Lewis Company, Box 3096, Tulsa, Oklahoma.





- System design by J. F. Pritchard Co., Kansas City, Mo.
- Operated by Allied Aviation Fueling Co., New York City.

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WARNER LEWIS COMPANY
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charge first exchanges heat with asphalt mix leaving the extraction tower and then with the D.A. oil mix or tower overhead. The feed is cooled to 150° F. to enter on a tray toward the top of the tower.

Propane charge is pumped on flow control by vertical multistage pumps onto the fifth tray from the bottom of the tower. There is a lower propane inlet below the trays, and additional cooling or heating of this stream is possible if needed. Propane can also be injected directly into the feed, prior to the last exchange for cooling and dilution before entering the treating tower. The propane used is that normally produced from our own HF alkylation unit. The extraction tower is a vertical 7½-ft.-diameter multistage unit which operates essentially liquid-filled and at 400 psig.

An interface level is maintained at the bottom so that the asphalt phase is the dispersed phase. The number of stages may be reduced by using alternate feed and propane inlets. A temperature differential through the tower is maintained by adjusting the propane and feed temperatures and by the use of heating coils in the top section of the tower. The bottom temperature normally operates at 120° F., with a top of 140° F. The cooler the temperatures, the harder the asphalt; or to put it another way, more gas-oil is extracted from the feed.

The deasphalted oil-propane mix from the top of the extraction tower flows by pressure control to the feed exchangers and then to the designated oil mix primary evaporator. The primary evaporator is a kettle-type unit. It contains a feed distributor to take the partially vaporized feed from the exchangers and a U-tube steam coil to provide heat from exhaust steam. A live steam coil is provided in the vapor space to act as a foambreaker if entrainment develops.

The flow is then to a secondary evaporator, where live steam is used for heating. The evaporated propane from both evaporators passes directly to the propane condenser and then to an accumulator for recirculation. The deasphalted oil flows on level control to the top of a 3-ft.-diameter stripper. There final traces of propane are stripped out with low-pressure superheated steam before going to the cat cracker charge storage.

The asphalt-mix stream from the base of the extraction tower passes on flow control through the feed exchanger to the asphalt-mix heater. The total stream is heated to 500° F. to prevent foaming and to drive off propane in a vertical 7½-ft.-diameter flash drum. The asphalt is then steam-stripped and sent to storage.

Propane from both low-pressure strippers goes to a direct contact condenser and compressor suction trap. There it is picked up by a 100-hp. motor-driven compressor and discharged into the propane condenser with propane from the evaporators for recirculation. Propane consumption is in the neighborhood of 10 bbl. per day. Most of this is lost in the deasphalted oil where it is recovered off the cat cracker.

Operating Variables

The operating variables for the unit are:

...1. Extraction tower temperature. This is the most critical operating variable and usually the most frequently used one to control product quality. In general, the higher top temperatures reduce the solubility of oil in the propane phase, and thus decrease the quantity and increase the quality of the deasphalted oil. The asphalt, on the other hand, will at the same time be increased in quantity and penetration, as it must contain more of the intermediate material rejected from the deasphalted oil.

If a high top temperature is used to improve the quality of the deasphalted oil, and simultaneously a low bottom temperature is used to produce a given grade of asphalt, the

TABLE 1
DIRECT OPERATING COSTS FOR 1958

(Based on 1,695 B/D charge) for Propane D. A.—Apco Arkansas City unit.

Item	Cents per barrel
Operating labor	4.28
Maintenance labor	1.08
Materials, supplies & services	0.72
Laboratory labor	0.94
Utilities:	
Fuel gas	1.17
Steam	3.04
Water	0.43
Electricity	2.22
Propane consumption	1.20
Total direct operating cost in cents per barrel of charge	15.08

TABLE 2—STREAM ANALYSES & PHYSICAL PROPERTIES

Asphalt From Propane Extraction

Pen. @ 77° F.	31	66	188
Sp. g. @ 60° F.			1.005
Ductility @ 77° F.	150+	150+	150+
Flash, Cleveland open cup °F.	640	635	655
Melting point	135	118	101
Solubility, CCl_4	99.78	99.88	99.82
Oliensis	neg.	neg.	neg.
Loss, 325° F., 5 hrs.		+0.001	+0.0038
Penetration after loss		59	170
% Original pen.		87.8	90
Thin Film:			
% loss		+0.0858	+0.1054
Pen. after loss		47	115
% of orig. pen.		71	61.2
Ductility @ 77° F. after loss		150+	150+
Spot after thin film	neg.	neg.	neg.

Typical Road Oil Blends

	RC-3	MC-3
Sp. g.	0.9738	0.9718
°API	13.8	14.1
Viscosity Saybolt Furol @ 140° F.	345	318
Distillation:		
IBP	316	460
% @ 437° F.	8.5	0
500° F.	10	4
600° F.	15	12.5
680° F.	16	16.0
% Residue	84	84
Pen. of residue @ 77° F.	101	198
Ductility @ 77° F.	150+	150+
Flash	135	180
Oliensis	neg	neg

	Deasphalted oil	Heavy vac. gas oil	Total cat charge
Gravity, °API	23.1	24.5	27.5
Flash, Cleveland open cup °F.	265	460	365
Conradson carbon, wt. %	2.292	0.382	0.480
Distillation:			
i.b.p.	366	434	575
5%	727	706	615
10%	658	720	631
50%	729	760+	694
90%	760+	...	749

treating tower may become flooded with the excess internal recycle produced. If the asphalt produced is the main product, the treating tower should be operated with a low temperature differential, 20°-25° F., until the approximate bottom temperature is determined. The top temperature can then be increased slowly until the optimum is reached.

... **2. Propane treat.** Increasing the propane ratio to feed generally produces the same effect as increased treating temperatures. However, the selectivity is normally better for more propane with lower temperatures. Capacity may be a limit to this.

... **3. Extraction tower stages.** The treating stages can be changed by alternate feed and propane connections. Increasing the number of stages should and does improve the asphalt quality for a given set of conditions.

... **4. Tower pressure.** Operation should be about 50 psi. above the vapor pressure of the solvent at the top temperature. Higher pressures tend to reduce the precipitating action of the solvent and should be avoided.

We have actually operated the unit to produce asphalt from 30 to 200 penetration. It can normally be operated within five numbers of the desired penetration.

Operating costs . . . Listed in Table 1 are the approximate operating costs of the propane deasphalter. These costs could be considered typical for this type of unit in this area.

Maintenance costs are very low because there is absolutely no corrosion and no scale buildup in any of the equipment. The unit is presently set up on a yearly turnaround schedule. This is mainly because of the necessary turnaround on the crude unit and vacuum tower which prepare the feed for the propane deasphalter without intermediate storage.

How Propane Deasphalting Helped

Since the vacuum-tower operating conditions are now mild, the wire-mesh blanket no longer has to be replaced every 6 months. The net slop-wax cut of 250 bbl. per day has been discontinued. The vacuum heavy gas oil is good quality for cat cracker feed, and the total cat charge has increased in quality and quantity. All of the oxidation equipment for reducing the vacuum bottoms to grade asphalt has been removed. This in itself has been a great improvement in our plant operation.

These are a few of the reasons that lead us to believe we made a step in the right direction by employing propane extraction for asphalt production.

Good asphalts are now the rule . . . Table 2 shows some of the typical analyses and physical properties of the products from propane deasphalting. Note the excellent ductilities and solubilities over the wide range of penetration asphalts. We believe this is due to the removal of heavy wax that would not be removed by vacuum distillation.

No difficulties exist in passing the Oliensis spot and thin-film tests. The cutback road-oil blends also have excellent properties, as shown in the tests for typical blends of RC-3 and MC-3 materials to the right of the table.

Cat cracker charge is also improved . . . Properties of some related streams are shown at the bottom of Table 2. The heavy gas-oil formerly ran 1.3 to 1.5 Conradson carbon residue and the cat cracker charge ran between 0.7 and 1.0 wt. %. The 0.48 wt. % is typical for our cat cracker charge now, and the gravity has been reduced 1° to the present 27.5° API. The cat unit performs very well on the deasphalted oil portion of the total charge. The material is a heavy waxy stock that is easily cracked.

Fig. 2 is a plot of the viscosity-temperature relation of different penetration asphalts now produced. The

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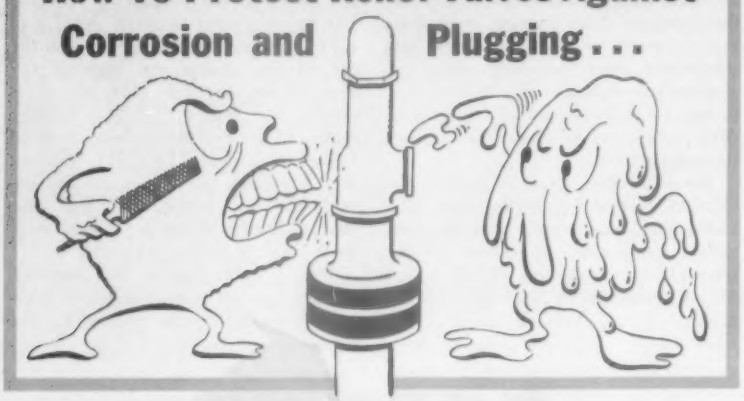
How To Protect Relief Valves Against Corrosion and Plugging . . .



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significance is that there is little difference from asphalts produced by the conventional vacuum-tower system, except for the specific improvement mentioned. The top curve (63-penetration asphalt) is 375 seconds Furol at 250° F. and down to about 35 seconds at 350° F. Values for higher penetrations are shown to have similar relationships.

BOOKS

PRINCIPLES AND PRACTICE OF GAS CHROMATOGRAPHY. By Robert L. Pecsok. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 226 pp. $6.75.

The first part of the book discusses theoretical principles underlying partition chromatography and describes the mechanics of separation when the mobile phase is an inert gas. This is followed by a more detailed description of the mobile and stationary phases. The practical details and general procedures are then described in chapters covering the effects of operational parameters, column selection and construction, sample introduction, and temperature control.

General methods available for converting the experimental data into useful results are discussed in the final chapter on analytical methods.

FUELS AND LUBRICANTS. By Milosh Popovich and Carl Hering. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 312 pp. $8.50.

This book surveys the field of fuels and lubricants, summarizing material from a great many sources in a single volume. The authors discuss the important fuels, including boiler, internal combustion engine, and jet fuels, as well as rocket propellents and nuclear fuels. They also examine the desirable properties of fuels and lubricants, the ASTM tests which are used to measure properties, and the interpretation, limitation, and significance of these tests.

The book discusses synthetic lubricating oils giving advantages, disadvantages, and uses. It includes a tabulation of octane numbers of many pure hydrocarbons.

It reviews hydrocarbon chemistry, outlining the refining process and the properties of petroleum products. It discusses fuel and lubricant specifications.

AMERICAN PETROLEUM REFINING. By H. S. Bell. Published by D. Van Nostrand Co., Inc., 120 Alexander Street, Princeton, N. J. 538 pp. $12.50.

Here is a picture of present-day practice for those who need an insight into the refining division of the oil industry.

This book shows why, how, and when modern processes and equipment were developed. It includes information on the chemical and physical properties of hydrocarbons, the characteristics of crude oils and products, and the relationship of auxiliary services such as power, water, waste disposal, and fire protection. Material on processes include flow charts and operating data.

The author avoids deep theoretical discussions and arduous examples. He makes it possible in this book for the producer, salesman, pipeliners, and tanker man to find information on a branch of the industry other than his own. The foreman of one department can easily learn what is done in another, while students of petroleum technology will find information on the refining branch of that industry.

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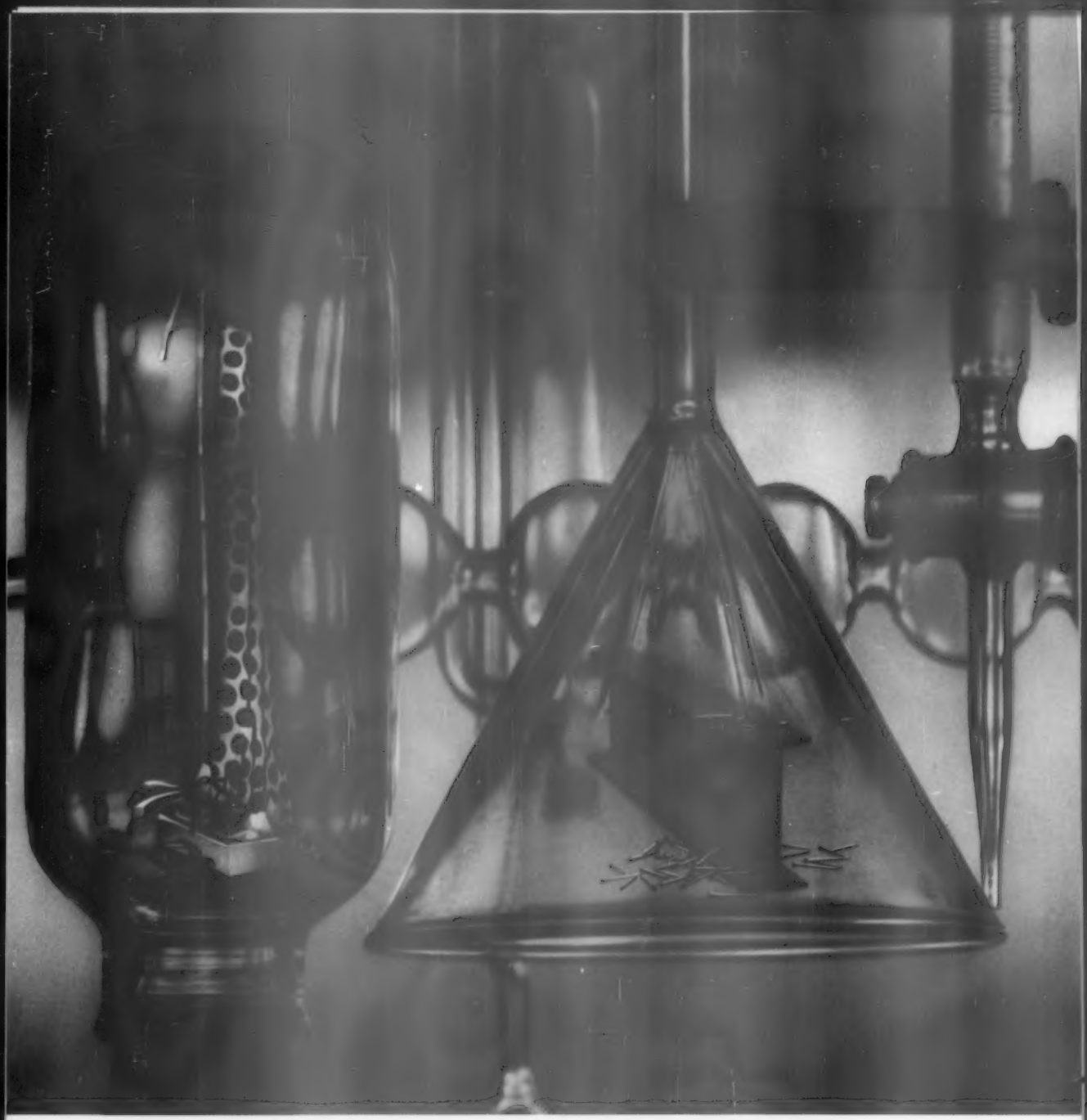

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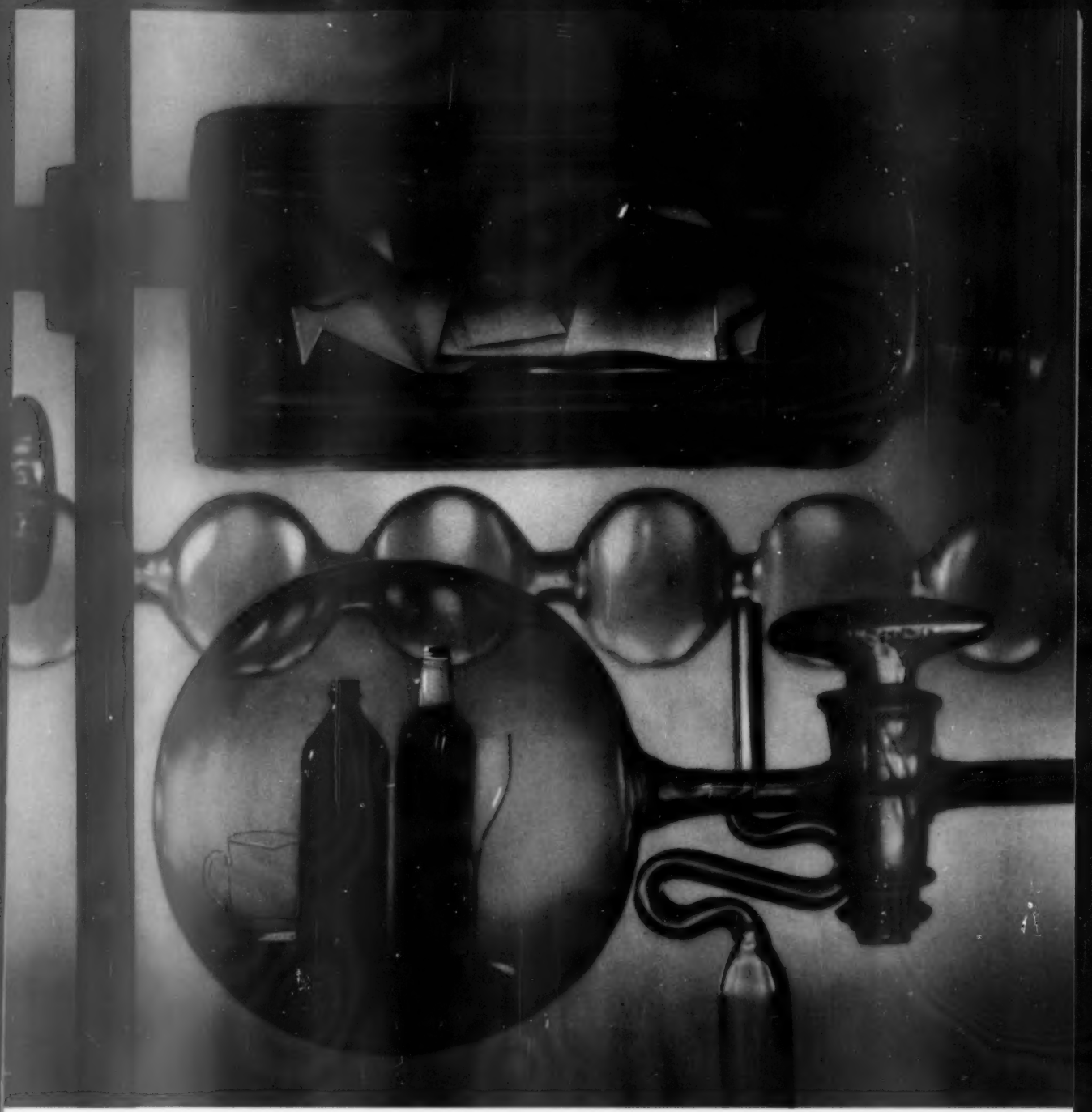

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Motorola ends costly power drain problems and idling expense with the first fully transistorized receiver and power supply

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2. MOTRAC radio eliminates the most common maintenance problems: vibrators in the power supply and tubes in the receiver. All are replaced by stabilized long-life transistors.

3. Up to 40°F cooler operation means less aging and strain on components. Reason: no more receiver tube filaments; a more efficient power supply; a battery saver switch to cut off transmitter filaments; and two separate heat sinks—one for power supply, another for transmitter output tubes.

4. The MOTRAC receiver operates directly from the 12-volt battery; its low voltage operation results in less electrical strain on components, assures long life.

5. Traditional Motorola engineering and production excellence are evident throughout MOTRAC radio. Transistors undergo three separate checks, including a week of stabilization at 185°F. Only industrial-type tubes, especially suitable for the rigors of mobile operation, are used in the transmitter.

6. Patient production testing continues under stringent quality control procedures. First, each module is tested. Then each chassis is independently checked. Next, each radio is tested as a composite whole. Finally, the entire radio and associated accessories are checked out as a complete operating system.

7. MOTRAC radio is conservatively designed. The receiver has *even higher* reserve gain than conventional Motorola units to assure *peak performance* for many years. Also, power supply transistors are operated under an exceptionally high safety factor to assure extended service life.

8. Completely independent receiver and transmitter chassis, with no power supply in common, assure reliable reception regardless of transmitter performance.

9. MOTRAC radio offers you 2½ to 3 times higher audio output than conventional sets.

10. MOTRAC radio is designed for split-channel operation. *Both* receiver and transmitter meet critical split-channel stability frequency requirements.

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TWO 15,000-HP. ELECTRIC MOTORS, largest on a pipeline, power this Mount Pleasant, Tenn., compressor station.

PROGRESS REPORT: Texas Eastern successful with

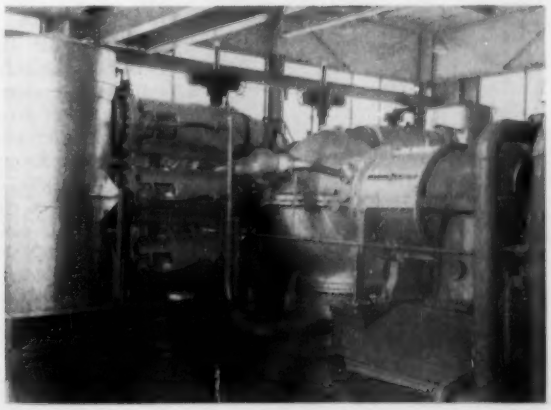
Large electric-motor and gas-turbine centrifugal compressor stations

BY PAUL REED
AND GENE KINNEY
Pipeline Editors

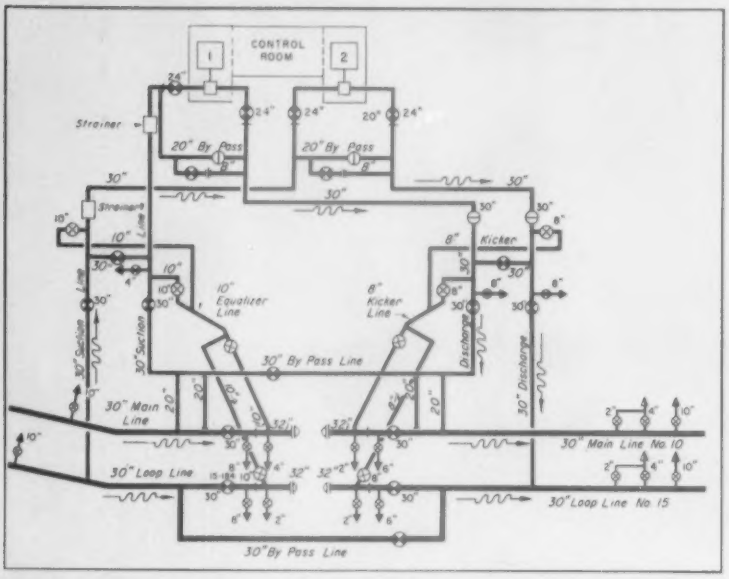
THE ECONOMY of extremely large electric-motor-driven centrifugal compressors is possible without sacrificing the reliability essential for a gas pipeline.

Because of this fact, the electric centrifugal, which has had somewhat limited application in gas transmission, may be considered for wider application in the future. The centrifugal compressor has in recent years gained in popularity, largely because of the

ELECTRIC MOTOR driving centrifugal compressor is one of two units in station shown above.



GAS TURBINE is one of four 7,600-hp. units driving centrifugal compressors at Clinton, Miss.



MAJOR PIPING at Mount Pleasant station located on double 30-in. line.

STRAINER replaces scrubbers at electric station.

rise of the gas-turbine drive. Examples of the latest types of both drivers are found on the Texas Eastern Transmission Corp. system.

In 1956 Texas Eastern built three stations powered by single 15,000-hp. electric-motor-driven centrifugal compressors, by far the largest in gas-transmission service. Last year, in a new expansion, second identical units were installed at two of the locations.

These stations, being on a double 30-in. main line from Kosciusko, Miss., to Oakford, Pa., pumping into underground storage, operate year-round at near the design capacity of 1 billion cubic feet daily. The application thus lends itself to concentration of horsepower as there is no need for flexibility.

The requirement of reliability has been fulfilled during the test of 3 years' operation. For example, the two 15,000-hp. units at Mount Pleasant, Tenn., have been on line 99.3% of their potential operating hours.

Electric investment cost . . . Concentration of horsepower reduced investment cost at Mount Pleasant and similar stations to the lowest figure reported for any compressor station in the industry.

Here is the construction-cost breakdown at Mount Pleasant:

Original station (one 15,000-hp. unit)	$1,880,000
Addition (second 15,000-hp. unit)	$1,638,000
Total cost	$3,518,000
Cost/horsepower	$117.27

With such low fixed charges, an electric station can absorb rather high operating costs and still be economic. However, this station has the advantage of low operating costs as well. Power is available at an average rate of 4½ mills per kwh. Maintenance is considered "negligible." Manpower requirements are low. The eight-man complement at the original station was not increased when the second unit was added, doubling station size. If desirable in the future, only supervisory equipment remains to be added to convert the local push-button operation to remote control.

Motor and compressor . . . Each driver at the new electric stations is a 15,000-hp. Westinghouse synchronous motor running at 900 r.p.m. at 4,160 volts and 1,580 amp., 3 phase, 60 cycle. The motor is totally enclosed and force ventilated.

Across-the-line starting is employed because of the large electric-power capacity available from a 161-kv. transmission line near the site.

The motor drives a De Laval overhung impeller single-stage centrifugal compressor through a speed increaser with a ratio of 7.299 : 1 which boosts speed to 6,506 r.p.m. The impeller is of all-welded construction.

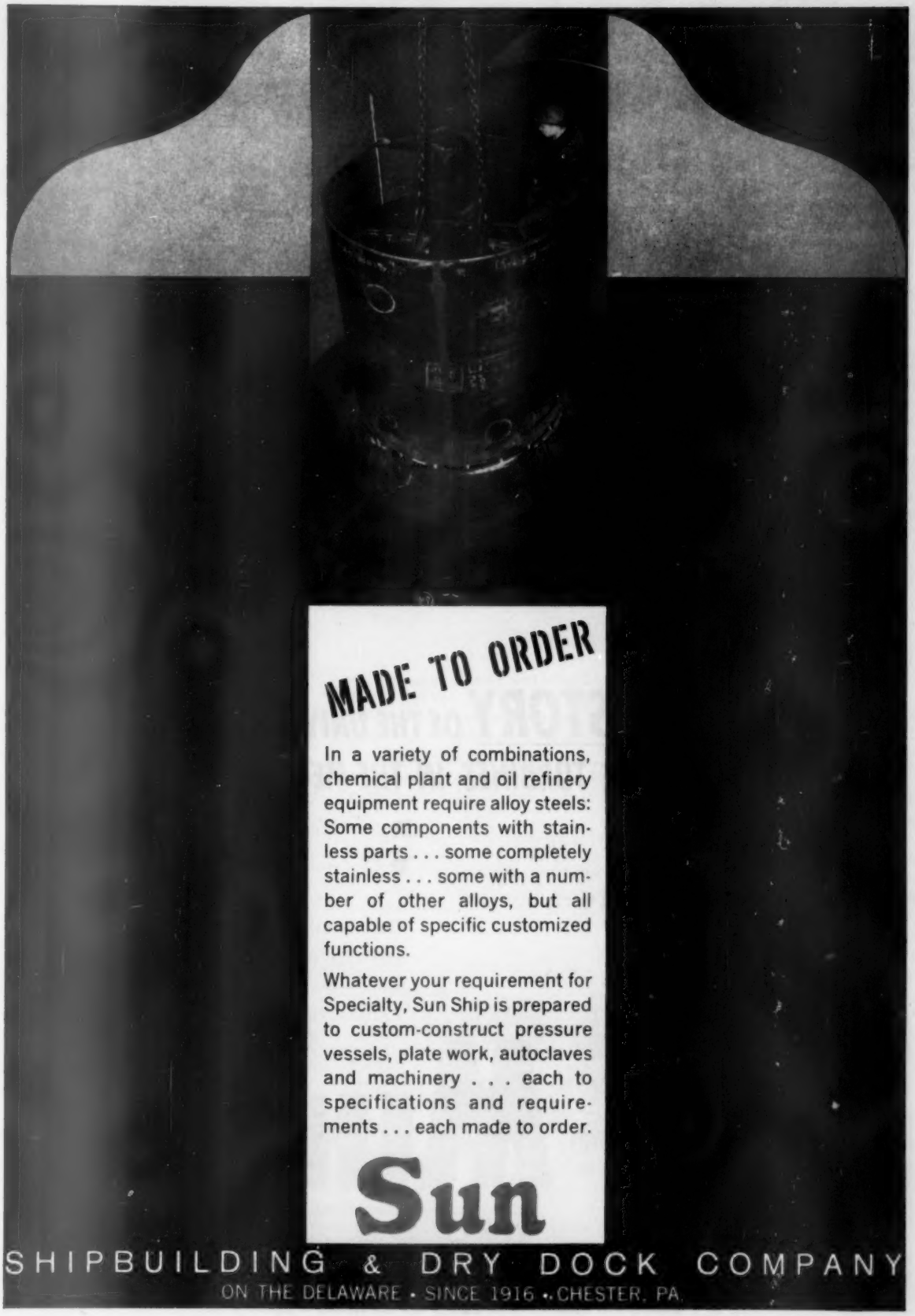
The compactness of the units is indicated by the size of each compressor room—62 ft. long by 28 ft. wide with 20-ft., 8-in. eave height. The control room, located between the two compressor rooms, is separated from them by an 8-in.-thick brick fire wall.

Electrical design . . . Purchased power supplies all requirements except for emergencies during a power failure when a 75-kw. engine generator is used. In the event of a power failure the generator automatically starts and supplies station lighting, control circuits, and electric valve operators until purchased power is again available. There are 48-volt batteries to provide for the d.c. control bus, circuit-breaker trip circuits, and station emergency-shutdown system.

Power equipment includes one 161-kv., 1,200-amp. outdoor oil circuit breaker; one 161-kv. steel substation structure with lightning arrestors and disconnect switches; two 12,000/16,000-kva., 3-phase transformers, high voltage 161 kv., low voltage 4,160 volts; two 225-kva., 3-phase transformers, 4,160/480 volts for the auxiliary load; two groups of 5-kv. outdoor metal-clad switchgear consisting of five cubicles each; one group of 480-volt motor-control center; two synchronous-motor field application cubicles; four instrumentation cubicles; and two control consoles.

The system is designed to be fail-safe. Units are push-button operation with automatic sequence and field application, and each unit is capable of separate and independent operation. To be fail-safe, the system uses two control buses, one 48-volt d.c. and one 230-volt a.c., with automatic forced sequence using the d.c. as the prime control-system bus. Loss of intelligence or a component failure will cause a shutdown.

Starting and shutdown sequence . . . Here's a condensed starting sequence: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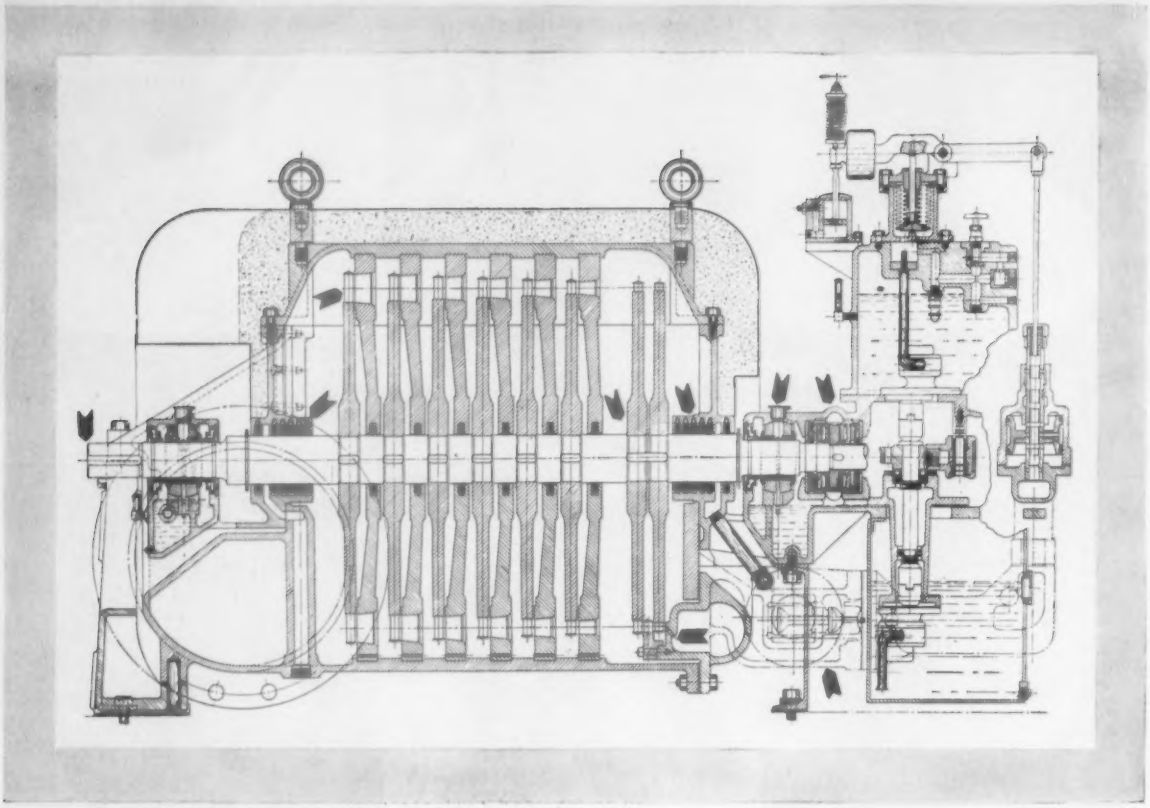

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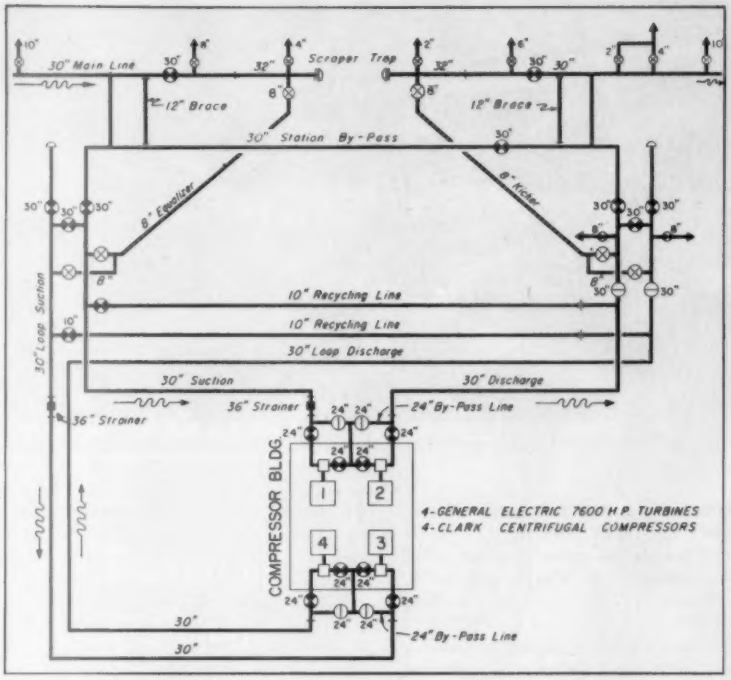


MAJOR PIPING at Clinton station located on 30-in. line.

1. If all permissive start devices are normal, the auxiliaries are started: air blowers for ventilation-system purging, lube-oil system pump, compressor seal-oil pump, and lube-oil air cooler fans in called for by the automatic temperature control.

2. Upon completion of the prime-mover air-purge time cycle and if the compressor seal-oil reserve tank has filled, the compressor-case pressurizing valve opens. The case vent valve remains open.

3. At the end of the gas purge time, the case pressurizing valve closes and case returns to atmospheric pressure.

4. The 15,000-hp. motor breaker closes.

5. The case pressurizing valve opens and the case vent valve closes after motor field excitation is applied and synchronization occurs.

6. The unit suction and discharge valves begin opening after the differential pressure between case and line has reached the prescribed setting.

7. The suction valve stops when it has opened to a preset position but the discharge valve continues to fully open.

8. When the discharge valve is full open, the control of the suction valve is given to the automatic load limiter. The suction valve will now open or close as directed by the load limiter.

Here is the shutdown sequence:

1. The 15,000-hp. motor breaker is tripped.

2. The compressor suction and discharge valves close.

3. The compressor vent valve opens.

4. When the case pressure has reached atmospheric pressure, the auxiliaries are stopped and the control system is reset for another start.

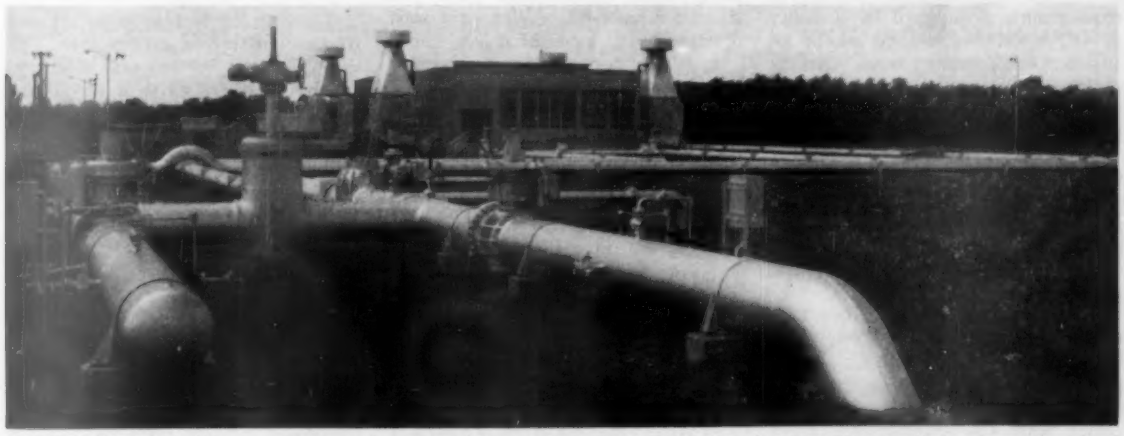
The shutdown sequence will occur automatically upon function of any shutdown protective device. The station suction and discharge valves will close and the station blowdown valve will open and exhaust the station piping to atmosphere when an emergency shutdown occurs.

Gas-turbine stations . . . Texas Eastern, deve'oper and largest user of the electric-centrifugal compressor, is also the largest user of the gas-turbine centrifugal in the gas industry.

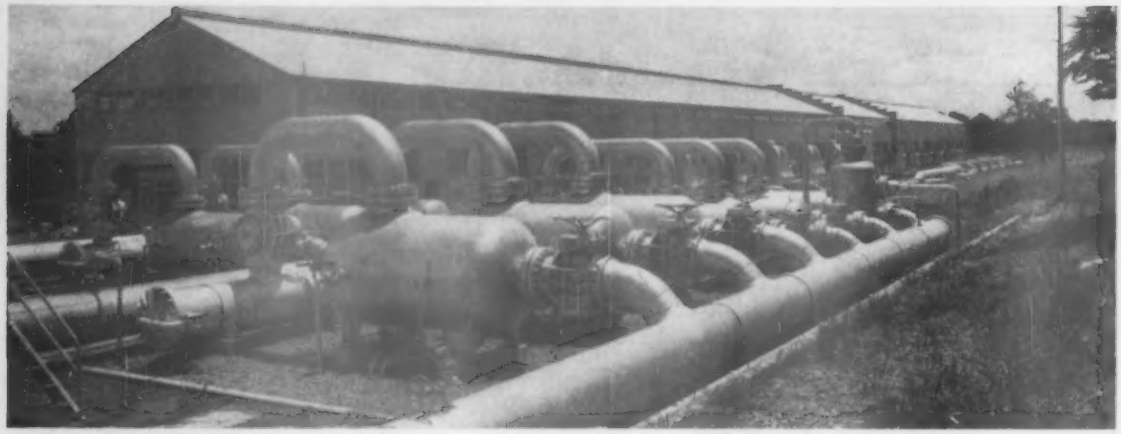
The Clinton, Miss., station has four GE two-shaft regenerative-cycle 7,600-hp. turbines driving Clark single-stage centrifugal compressors. There are two parallel banks of units with two units operating in series in each bank. There are four such stations on the system and a fifth has two units of this type. They represent the modern multiunit turbine station which is assuming a larger role in gas transmission.

Speed of the power gas turbine is 5,400 r.p.m. Fuel consumption is between 9 and 10 cu. ft. of natural gas per hp.-hr. Operation over a wide range of speeds on the gas compressor without much sacrifice in fuel economy is possible because of the split-shaft design of the turbine. Thermal efficiency is improved by the use of a regenerator with each turbine.

This type of station also features low initial cost:



CLINTON STATION offers comparison of a gas-turbine station exterior with the electric station on first page and reciprocating station on next page.



RECIPROCATING STATION at Kosciusco, Miss., with scrubbers in foreground, has 35,000 hp. and cost some 9 million dollars.

Original station (two 7,600-hp. units)	$3,053,000
Addition (two 7,600-hp.) units)	$3,111,000
Total cost	$6,164,000
Cost/horsepower	$202.76

"Straight-through" piping between gas compressors, pioneered by the company, helps to cut first cost and minimize pressure drop between units. This station, like Mount Pleasant, uses a strainer instead of gas scrubbers on the suction line.

Clinton, which is also adaptable to remote control, has 14 men—1 chief operator, 4 operators, 1 operator-oiler, 3 oilers, 1 relief oiler, 1 repairman, 1 mechanic's helper, 1 maintenance man, and 1 electrician. An electrician is needed at this station, while none was required at the station with 30,000 hp. in electric motors, because of the more complex sequence control on the turbine.

Electrical design . . . Purchased power for starting and operations-power requirements is supplied by a utility at 480 volts, 3 phase, at which all auxiliary equipment operates. This includes pumps, cooling fans, electrical space heaters, and yard-area mercury-vapor lights.

A 300-kw. gas-engine generator takes over if purchased power fails. A 125-volt nickel-cadmium battery provides power for the d.c. control bus, emergency instrumentation power, emergency lighting, and the emergency station shutdown system.

Power equipment includes five 125-volt d.c. cubicles with a circuit-breaker panel board and d.c. multipoint starters for emergency pumps; one section of 480-volt motor control center with 480-volt circuit breaker panel board, 120-volt circuit breaker panel board, and a.c. starters for auxiliary equipment; one section for 480-volt purchased-power service breaker and control; one one section for 480-volt auxiliary generator service breaker and control.

The system is designed fail-safe and will continue to run on a purchased-power outage until the auxiliary generator picks up the load. If the emergency power fails also, the turbines will shut down safely using power from the battery.

Starting and shutdown sequence . . . There are two turbine control buses, a 125-volt d.c. and a 120-volt a.c., solidly grounded, with the d.c. as the prime control-system bus. Here is a condensed automatic starting sequence for one turbine:

1. All control and safe run switches must be on in order for a turbine to start.

2. Green "auxiliary check" and "permissive-start" lamps will be lit.

3. When the start switch is operated, auxiliary lube-oil pumps start, seal-oil pump starts, cooling-water pump starts, cooling-water fans start if needed, lube-oil cooling fans start if needed, and air-filter drives start.

4. When normal operating conditions are reached by the auxiliaries, starting gas is admitted to the cranking turbine, allowing it to break away the unit and accelerate to 10% speed where it is held for 5 minutes to allow incoming air to purge the turbine and associated ducting.

5. At the same time the compressor pressurizing valve is opened. The gas passes through the compressor and out the vent valve, purging the compressor. When the pressurizing valve is completely open the vent valve is closed, thus pressurizing the compressor case.

6. After the differential pressure between compressor case and line has reached the prescribed setting, the unit suction and discharge valves begin to open. The pressurizing valve then closes.

7. After 5 minutes' purge time, the ignition is turned on and fuel gas is admitted to the turbine. On combustion the red "flame" lamp is lit and the turbine is held for 2 minutes for warmup.

8. Acceleration gas is admitted to the cranking turbine and additional fuel gas is admitted to the gas turbine to accelerate the unit to 60% speed.

9. Additional fuel gas is admitted to the gas turbine which now becomes self sustaining and is placed under the control of the load governor.

10. The gas supply to the cranking turbine is terminated, causing it to declutch from the gas turbine and roll to a standstill.

11. The station recycle valve, which is open at unit shutdown, is closed, placing the unit on the line.

12. Load on the unit is varied by raising or lowering the turbine load governor.

Here is the shutdown sequence:

1. When the "stop" is operated, fuel gas to the turbine is halted and combustion thus is extinguished.

2. The unit suction and discharge valves are closed. The vent valve is opened and the compressor case is reduced to atmospheric pressure. The station recycle valve is opened.

3. The unit rolls to a standstill and controls reset. Auxiliary pumps and fans continue to maintain cooling for 2 hours' cooldown.

4. Upon failure of the sequence to complete its normal cycle, or upon action of a protective device, the shutdown is done automatically.

5. An emergency shutdown also causes the station suction and discharge valves to close and the station blowdown valve to open and exhaust the station piping to atmosphere.

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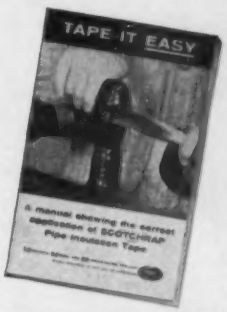

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MINNESOTA MINING AND MANUFACTURING COMPANY
. . . WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

BY W. L. NELSON
Technical Editor and
Petroleum Consultant

Questions on
TECHNOLOGY

What is adequate storage capacity?

We recently saw in the literature, the figure of 20-30 bbl. of product storage capacity for a refinery. We have much more storage. Are we managing poorly? F.T.M.

The needs of refiners vary so widely that an average means little, i.e., there are usually good reasons for the storage capacity that a refiner has accumulated. Table 1 shows storage capacities taken from the literature.

Crude-oil-storage capacity is vitally dependent on the mechanics of supply. A refinery situated on a major pipeline or a small refiner situated in the vicinity of oil fields, needs only a small reserve supply of oil, only enough storage to segregate (or by mixing) a somewhat uniform feed material. This is especially true of small refiners who operate their own supply lines. However, in the extreme, it is difficult to operate with less than about 10 days of supply (10 bbl. per daily barrel capacity).

At the other extreme, refiners who receive oil from far-removed sources by tanker must have a larger crude-oil storage because failure of one tanker to arrive on schedule can disrupt the entire operation unless stored oil is available.

The independent is in a much stronger position because producers are always looking for outlets and are therefore prepared to do anything possible to keep the oil moving.

At one time it was common practice to speculate on the price of crude oil and this accounts for the very large crude storage (287 bbl.) of Refinery L in the table. This is really a tank farm and it ordinarily would not be classed as refinery crude-storage capacity.

With respect to product storage, Table 1 indicates about 41 bbl. per daily barrel of refinery capacity. This is probably a little smaller than a true average. The seasonal nature of demand for gasoline justifies some storage of gasoline during the winter and the storage of fuel oils during the summer. This is especially true for the Mid-Continent where fuel oil is in excess.

However, the investment for such storage is limited by the constant need of funds for process improvement and thus product storage should pay for itself in 2 years if possible, just as any improvement or expansion. This type of speculation has been much less evident during recent years, since the development of large product pipelines.

Product storage is also somewhat a function of the number of products handled. Thus in the simplest refinery, about 8 types of major products would be handled (bottle gas, two gasolines, kerosine, No. 2 distillate, residual fuel, natural gasoline or isobutane, and one other product), whereas at least 36 major products would be handled at a complex refinery. An equation similar to the following might represent the general situation:

$$1.75 \text{ No. of Prod.} + 10 = \text{Product Storage}$$

This gives 24 bbl. of storage capacity per daily barrel of crude-oil capacity for the simplest plants whereas a complex plant requires 73 bbl. of product storage. If this is coupled with a minimum crude storage capacity of about 8, and a maximum of about 40 (excluding any capacity for speculation) the ranges of storage capacity are somewhat as:

	Crude	Products	Total
Simplest plants	8-40	18	26-58
Complex plants	8-40	58	66-98
Average plant	30	40	70
Average simple plant	30	18	48
Average complex plant	30	58	88

Major refiners operate the simplest and the most complicated plants, but nearly all refineries operated by independent operators tend to be average or complicated because a main reason for the continuance of small refiners in the business is the various specialty businesses that they have developed.

TABLE 1—STORAGE CAPACITY OF A FEW REFINERIES

Refinery	Capacity, B/D	Storage cap., bbl. per daily barrel: Date	Total	Crude	Products	Tank: No.	Tank: Avg. bbl.	Location	Notes
A	100,000	1951	.....	.....	31.21	.....	.....	East Coast	Computed—operating at constant capacity
B	100,000	1951	.....	.....	37.97	.....	.....	East Coast	Computed—constant capacity, constant yields
C	150,000	1957	47.6	.....	.....	600	11,900	East Coast	.....
D	157,000	1957	56.1	21.7	34.4	.....	.....	East Coast	248.0 bbl. capacity per acre area
E	183,000	1957	65.6	18.6	47.0	.....	.....	East Coast	187.0 bbl. capacity per acre area
F	160,000	1957	50.0	.....	.....	.....	.....	East Coast	80.7 bbl. capacity per acre area
G	130,000	1957	53.9	.....	.....	.....	.....	East Coast	289.0 bbl. capacity per acre area
H	80,000	1957	64.1	26.6	37.5	.....	.....	East Coast	80.0 bbl. capacity per acre area
I	66,000	1957	112.5	.....	.....	.....	.....	East Coast	92.4 bbl. capacity per acre area
J	35,000	1956	108.0	.....	.....	63	.....	East Coast	27.0 bbl. capacity per acre area
K	62,000	1954	81.2	.....	.....	.....	8,500	Mid-Cont.	.....
L	35,000	1945	*287.0	.....	.....	.....	.....	Mid-Cont.	Large crude storage for speculation
M	20,000	1949	43.3	9.1	34.2	.....	.....	Mid-Cont.	.....
N	25,000	1950	120.0	.....	.....	.....	.....	Mid-Cont.	.....
O	.....	1957	75.0	12.0	63.0	.....	.....	Canada	On large crude-oil pipeline
P	35,000	1950	62.8	.....	.....	.....	.....	Venezuela	Served by 50,000-B/D pipeline
Q	330,000	1950	66.7	.....	.....	.....	.....	Caribbean	.....
R	430,000	1950	49.0	11.6	.....	.....	.....	Caribbean	.....
S	120,000	1954	50.0	.....	.....	.....	60,000	Middle East	Serves large areas of Far East
Average	.....		*69.0		41.0				

*The abnormal 287 not included in average.

five famous rope jobs

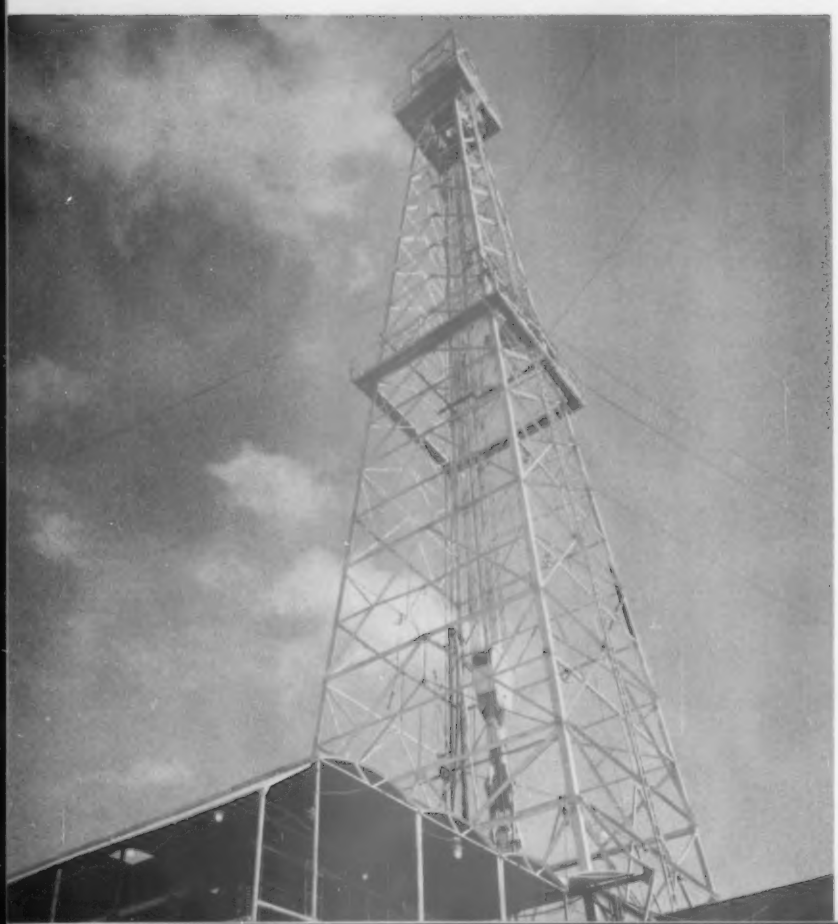
The Mighty Mackinac

World's longest suspension bridge. The main cables took 42,000 miles of wire—enough to go almost twice around the world. The roadway is supported by 125,000 feet of USS Tiger Brand Bridge Rope. Both wire and wire rope were made by American Steel & Wire.

(SEE FOLLOWING THREE PAGES)

Building Glen Canyon Dam

4-inch-diameter Tiger Brand Track Cables, the largest ever made in this country, span the Colorado River for these cableways. Carrying 12-cubic-yard buckets of concrete or loads up to 50 tons on each trip, they are helping to efficiently build the nation's second tallest dam, requiring 5 million cubic yards of concrete and thousands of tons of steel.



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The search for oil goes deeper every day and stronger, tougher Tiger Brand Wire Rope is lifting the tremendous weight of drill pipe and casing necessary to drill the well. This is one of the world's deepest.

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The new power plant at Niagara Falls will generate 2,190,000 kilowatts of electricity, and will be the Free World's No. 1 producer of hydroelectric power. Huge shovels, rigged with Tiger Brand Wire Rope, are tearing away the rocks to make room for the power plant.

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On the last page of this advertisement you will see some of the research, engineering and manufacturing facilities that are necessary to produce this top-quality wire rope. To get the complete story, write for our descriptive book. American Steel & Wire, Room 842, 614 Superior Ave., N.W., Cleveland 13, Ohio.

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(TURN TO NEXT PAGE)

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Quality Control
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In water flooding: Use these graphical methods to determine . . .

• When radioactive water tracers reach well
• What tracer concentrations to use

BY G. E. VAUGHN, JR., AND J. WADE WATKINS

EVALUATIONS of field tracer tests are rarely found in the literature because of the tedious calculations required. A method based on assumed homogeneous reservoir conditions for a five-spot pattern is described here for determining arrival times at the production wells of any injected tracer. The concentration of tracer to be injected to insure detection, and the optimum time over which injection should occur are included.

The method can be extended for use with any flooding pattern for which the pressure distribution can be determined. In respect to tracer dilution or loss, only mechanical or physical dilution is considered, with any effect of diffusion, adsorption, ion exchange, or other probable causes of tracer loss or dilution ignored for purposes of this paper.

To simplify calculations from available data, the problems involved in predicting arrival times and concentration of tracer in the produced fluids can be approached most conveniently under assumed homogeneous conditions of the reservoir and subsurface fluids. Then, the concentration of tracer in the produced fluids will depend on: (1) The extent of dilution with barren fluid at the producing well; (2) the volume of tracer-bearing slug; and (3) the input tracer concentration.

Physical and Mathematical Relationships

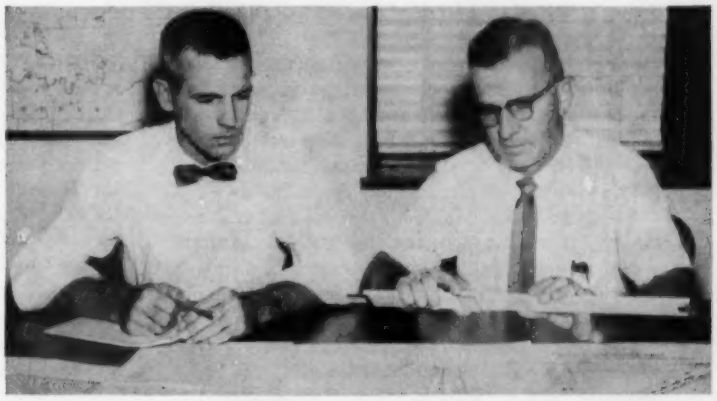
To study the effect of permeability, saturation, porosity, well spacing, and pressure distribution on the concentration of tracer material in the produced fluids these assumptions were made:

1. Reservoir rock and fluid properties are uniform throughout.
2. Steady-state, homogeneous fluid-flow conditions exist.
3. The one-quarter element of the five-spot is one of a symmetrical pattern.
4. Distribution of pressure is independent of well spacing and of the actual value of the pressure difference.
5. Viscosity of the injected fluid is not changed by adding tracer material and equals the viscosity of the displaced fluids.
6. Fluid saturation remains constant.
7. Analysis is based on a linear flow relation along each flow path.
8. There is no loss of tracer because of diffusion or adsorption or other possible causes in the reservoir system, and the interface between the injected tracer-bearing fluid and the system fluid is vertical.
9. Input concentration of tracer is calculated at the sand face in the injection well, and the output concentration is calculated upon entrance of the tracer into the production well.

From these assumed conditions the distance of travel in any increment of time along a flow path can be calculated when the pressure distribution is known. Since the velocity of a particle traveling along any path is proportional to a function of the permeability-viscosity ratio and the pressure gradient, the increment of time for travel along increments of distance of the flow path may be expressed by the differential equation:

$$dt = \frac{u\phi}{k}\, dl \frac{1}{dp/dl} \qquad 1$$

Meet the authors



G. E. Vaughn, Jr., left, is assistant professor of petroleum engineering, University of Missouri School of Mines and Metallurgy, Rolla. He has held this position 3 years. Before that time he acquired 8 years of industrial experience with The Texas Co. and Schlumberger Well Surveying Corp. Vaughn holds BS and MS degrees in petroleum engineering from the institution where he now teaches.

J. Wade Watkins, right, is supervisory chemical engineer and research project coordinator, Region IV, Bureau of Mines. He joined the bureau in 1943. Prior to that time he was a chemist for 10 years at the Potwin, Kans., refinery of Vickers Petroleum Co. Watkins is a graduate of University of Wichita.

Aerial view of treatment plant shows Dorrco Clariflocculators in left foreground, and Clarifiers at upper left. Distributor is at upper right.

HOW SHELL SOLVED A REFINERY WASTE DISPOSAL PROBLEM

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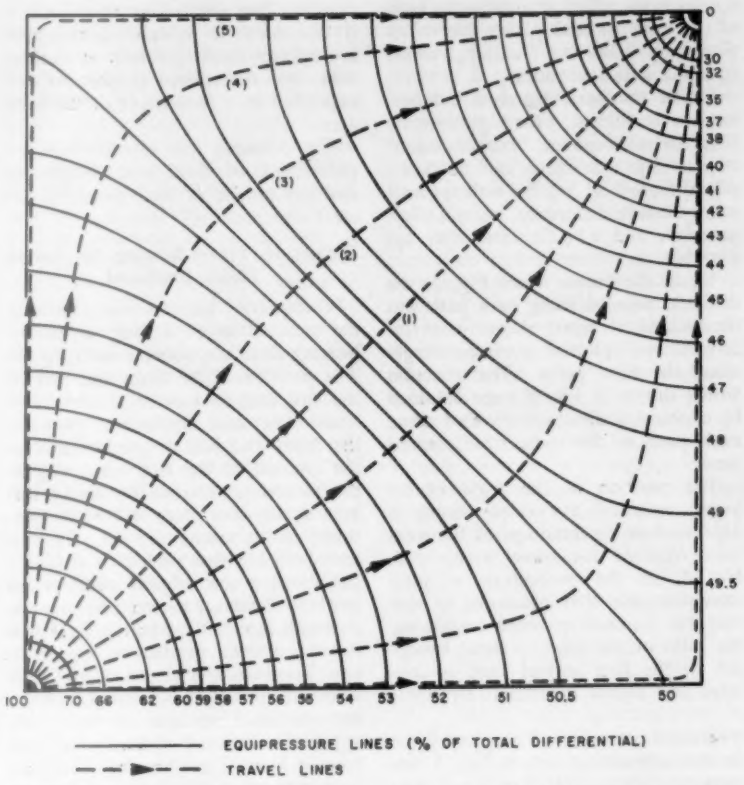


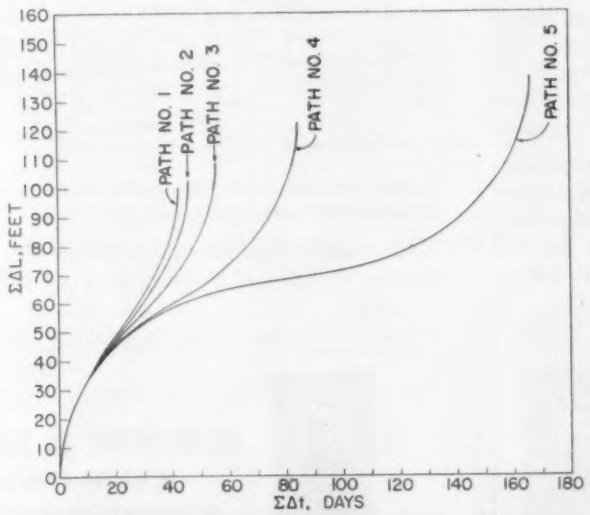
PRESSURE-DISTRIBUTION and travel lines for two wells of homogeneous five-spot pattern. Fig. 1.

Equation 1 cannot be written in a form suitable for direct solution, but an approximate solution can be obtained graphically by scaling along any flow path the distance between successive points of known pressure differentials. These scaled values can then be applied in a simplified approximation of the solution of the above equation:

$$\Delta t = \frac{u\phi}{k} \frac{(\Delta L)^2}{\Delta P} (0.158) \qquad 2$$

where,

Δt = time for injected front advance between equipressure lines along a flow path, days.
ΔL = distance between equipressure lines along a flow path, ft.
ΔP = pressure difference between equipressure lines, psi.
u = viscosity of injected and system fluids, cp.
k = permeability of the medium, darcies.
ϕ = fraction of pore space occupied by moving front, porosity times saturation, decimal fraction.
0.158 = unit conversion constant.



INSTANTANEOUS-VELOCITY CURVES for particles moving along flow paths between two wells of homogeneous five-spot pattern. Fig. 2.

Method of Calculation

The calculations for this study were performed in successive steps as follows:

1. Graphical solution of Equation 2 to obtain the summations of travel times, which were used to plot an instantaneous velocity curve along each flow path.
2. Calculation of the time of first arrival at the production well of any injected material by using the approximate solution of Equation 1 along the diagonal flow path (path No. 1).
3. Plotting of the position of the injected front at any given time.
4. Calculation of the areal (unit volume) sweepout with respect to time.
5. Calculation of the ratio of tracer-bearing fluid to barren fluid produced with respect to time.

Instantaneous velocity curves . . . Using the pressure distribution and flow lines shown in Fig. 1 for a one-quarter symmetrical element of the five-spot pattern, the increment of time for travel between each equipressure line along the flow paths was calculated. This was done by graphically solving Equation 2. Values of total pressure difference of 100 psi., injection-well to production-well distance of 100 ft., and a ratio of $u\phi/k$ of unity were assumed, so that the calculations represent either percentage or unit values.

The ratio of $u\phi/k = 1$ represents such conditions as fluid viscosity, 1 cp.; porosity, 20%; saturation, 75%; and effective permeability, 150 md.

The distance between equipressure lines was scaled in feet, and the pressure differential between the equipressure lines was in psi.; thus, the time required for traveling the scaled distance was calculated in days as shown in Equation 2.

Fig. 2 shows the instantaneous-velocity curve for each of the flow paths. These curves were obtained by plotting the summation of progressive increments of distance, ΔL in feet,

versus the summation of time intervals, Δt in days, necessary for traveling the corresponding distance.

Approximate first arrival times . . . The summation of the increments of time along the diagonal flow path (No. 1) is the time of the first arrival at the production well of any injected material. The equation expressing the approximate solution of the basic equation shows that the first arrival time is directly proportional to the fractional permeability-viscosity ratio, $u\phi/k$, and the ratio of the travel distance, L, to the reciprocal of the pressure gradient, $1/dp/dl$.

Using this proportionality, Fig. 3 was plotted to show the relation between approximate first arrival time in days, well spacing in feet, and pressure gradient in psi. per foot at various fractional permeability-viscosity ratios in centipoises per darcy. The proportionality between arrival time and these parameters is based on the pressure distribution given in Fig. 1, which accounts for the effective well radii of the system shown.

In cases where pressure distribution is not known, it has been shown that, by using a volumetric relation combined with radial flow calculations, the proportionality may be altered to include the effective well radii at the wells involved. The times shown in Fig. 3 can be changed to include the approximate effect of changes in radii of the wells by multiplying the values shown by $0.389 \log (L/2)/r_w$, where r_w is the well bore radius.

Under the basic assumed homogeneous conditions, the approximate first arrival time or "breakthrough" of any injected tracer can be determined from Fig. 3 if the well spacing, total pressure difference, permeability, porosity, and fluid saturation are known.

Using the curves from Fig. 2, the distance traveled along each path was determined at equal elapsed-time intervals and plotted correspondingly along the flow paths. The injection fronts shown in Fig. 4 were obtained by connecting distances traveled along each path in the same total elapsed time.

The position of the front of injected material at various times is expressed as a percentage of the total time required for travel along path No. 5, or the percentage of total sweepout time. It is interesting to note that, for the basic assumed conditions, the ratio of the time for total sweepout to the first arrival time is constant and equals approximately 4.

Sweepout curve . . . The plot of the frontal advance shown in Fig. 4 was used to determine the reservoir area or unit volume swept out with respect to time. The area of sweepout which is equivalent to volumetric sweepout at constant sand thickness at various times was determined graphically and expressed as a percentage of the total area.

Fig. 5 shows this relation between percentage of total area swept out and percentage of time required for total sweepout.

Ratios of Tracer-Bearing to Barren Fluids Produced

Volumetric calculations involving the production of a slug of tracer-bearing fluid are possible with Fig. 5. The position of the front and rear of the slug can be located at any given time. The area represented between the front and rear is proportional to the amount of the slug remaining in the reservoir. The difference in this area at any two times will be proportional to the amount of the slug produced during that period of time.

Following the original assumptions that the fluid saturation remains unchanged, injection of barren fluid will result in total production equal to total injection. As injection continues after the initial tracer breakthrough, the produced volume of fluid will equal the injected volume and will contain both tracer-bearing fluid and barren fluid.

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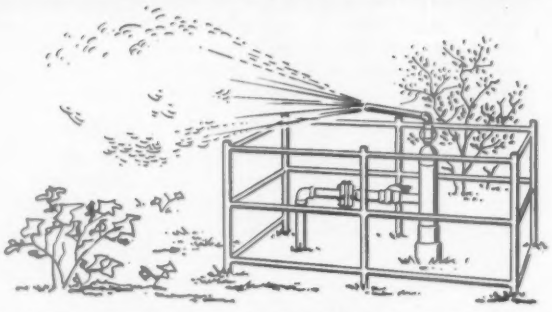
This treatment can remove brine accumulations from relatively deep wells . . . remove heavy oil from the sand face, casing and tubing . . . and remove clays, scale, mud and solid particles from the well bore and pipe string. Where heavier brines are involved, the use of TRITON X-165 is indicated because it is slightly more water-soluble.



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From this, the total produced volume during any time interval is known and the amount of tracer-bearing fluid is known. Therefore, the concentration or ratio of tracer-bearing to barren fluid can be calculated.

To illustrate this calculation, assume uniform injection of tracer-bearing fluid equal to 10% of the reservoir volume available for fluid transmission followed by increments of 7.2% injections of barren fluid. The slug will occupy a position represented between 25.5 and 21.75% of total sweepout when the front first reaches the producer. This position can also be represented as being between 70.9 and 60.9% of total sweepout volume.

At the end of the first incremental injection of barren fluid, the slug will occupy a position represented by 76.5 and 67.6% of total sweepout volume. This indicates that, during injection of 7.2% reservoir volume of barren fluid, 1.1% of tracer-bearing and 6.1% of barren fluid were produced, equal to a produced ratio of tracer-bearing to barren fluid of 0.18.

Fig. 6 shows the results of this calculation for various slug volumes expressed as percentage of total reservoir volume available for injected fluid. The resulting curves show the relation of the ratio of tracer-bearing fluid to barren fluid in the produced fluids to the percentage of time required for total displacement of the slug. It should be noted that the ratio given in Fig. 6 is the ratio of tracer-bearing fluid to the barren fluid produced and is not the actual concentration of tracer in the produced fluids.

Since Fig. 6 gives the ratio of tracer-bearing fluid to barren fluid, the ratio of tracer concentration at the injection well to the tracer concentration at the production well can be calculated for any percentage of reservoir pore volume injected. The injection concentration will be reduced at the production well by a dilution factor which can be determined from Fig. 6.

For any reservoir pore volume injected that factor will be (produced-volume ratio + 1)/(produced-volume ratio). The relation of the dilution factor to the injected and produced water concentrations is given by the following equations:

$$C_i = C_o\,(R + 1)/R \qquad (3)$$

or,

$$C_i/C_o = (R + 1)/R \qquad (4)$$

where,

C_i = tracer concentration at the injection well
C_o = tracer concentration at the production well
R = produced-volume ratio
$(R + 1)/R$ = dilution factor

Fig. 7 shows the relation of the dilution factor at 80% of the maximum value of the produced-volume ratio, R, to the percentage of reservoir pore-space volume injected. This curve may be used to determine the injection concentration necessary for an output concentration which can be detected using devices with given sensitivities. Also, the output concentration to be expected for any given input concentration can be calculated.

Application

It is recognized that this theoretical method has some limitations. Although many factors may contribute to the loss of a tracer substance in a porous, permeable formation, the only cause considered in the present discussion is physical dilution by water that does not bear tracer. Losses of tracer may also occur because of adsorption, ion exchange, hydrolysis and precipitation, diffusion, replacing of connate water, and other unknown effects.

Conversely, as homogeneous conditions have been assumed between wells, no allowance has been made for the effects of permeability stratifica-

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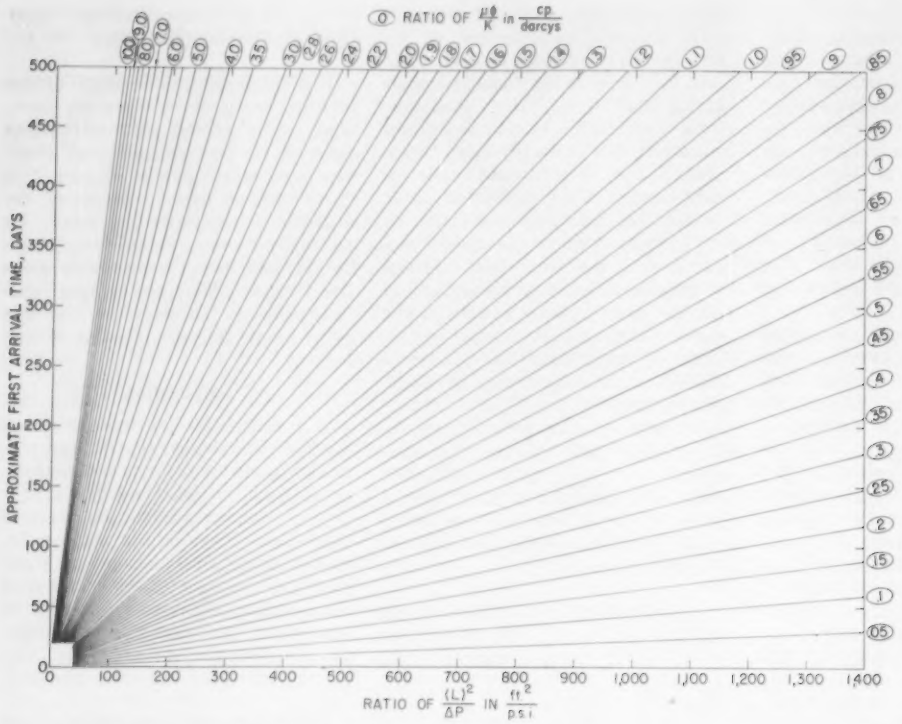


FIRST arrival time at production well of tracer injected into homogeneous five-spot pattern is shown on this two-well graphical representation. Fig. 3.

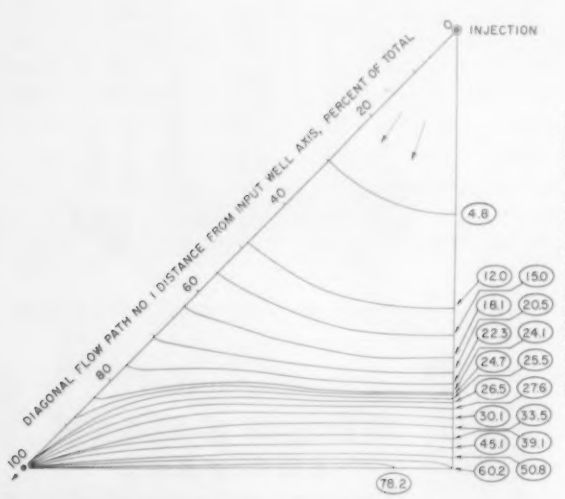
tion except for instances in which the thickness and permeability of such zones are known. Tracer substances usually are evaluated to determine their potential loss and are selected on the basis of expressed low adsorption and ion exchange and negligible hydrolysis.

If the loss of tracer from these causes is comparatively low, it is expected that the method described here may yield a reasonable approximation of transit times and tracer dilution between wells. Obviously the method is not applicable if the tracer moves from injection wells behind pipe and into upper formations or travels through fracture systems between wells.

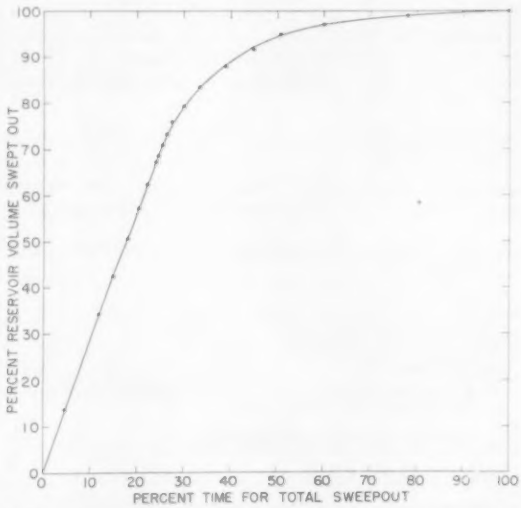
Although the method is based on homogeneous physical conditions, its benefits should be realized when enough field data are available for comparison. Assuming no tracer losses from various causes, the first arrival time and the shape of the produced-tracer-ratio curve will be influenced by reservoir heterogeneities in such a manner that some estimate of non-uniform reservoir conditions can be made.

In general, a travel time less than that predicted by theory probably will indicate channeling either through fractures or extreme permeability variations. If the time of first arrival were greater than that predicted by this method, the indication is that the reservoir factors, probably permeability and/or fluid saturation, have been incorrectly assumed.

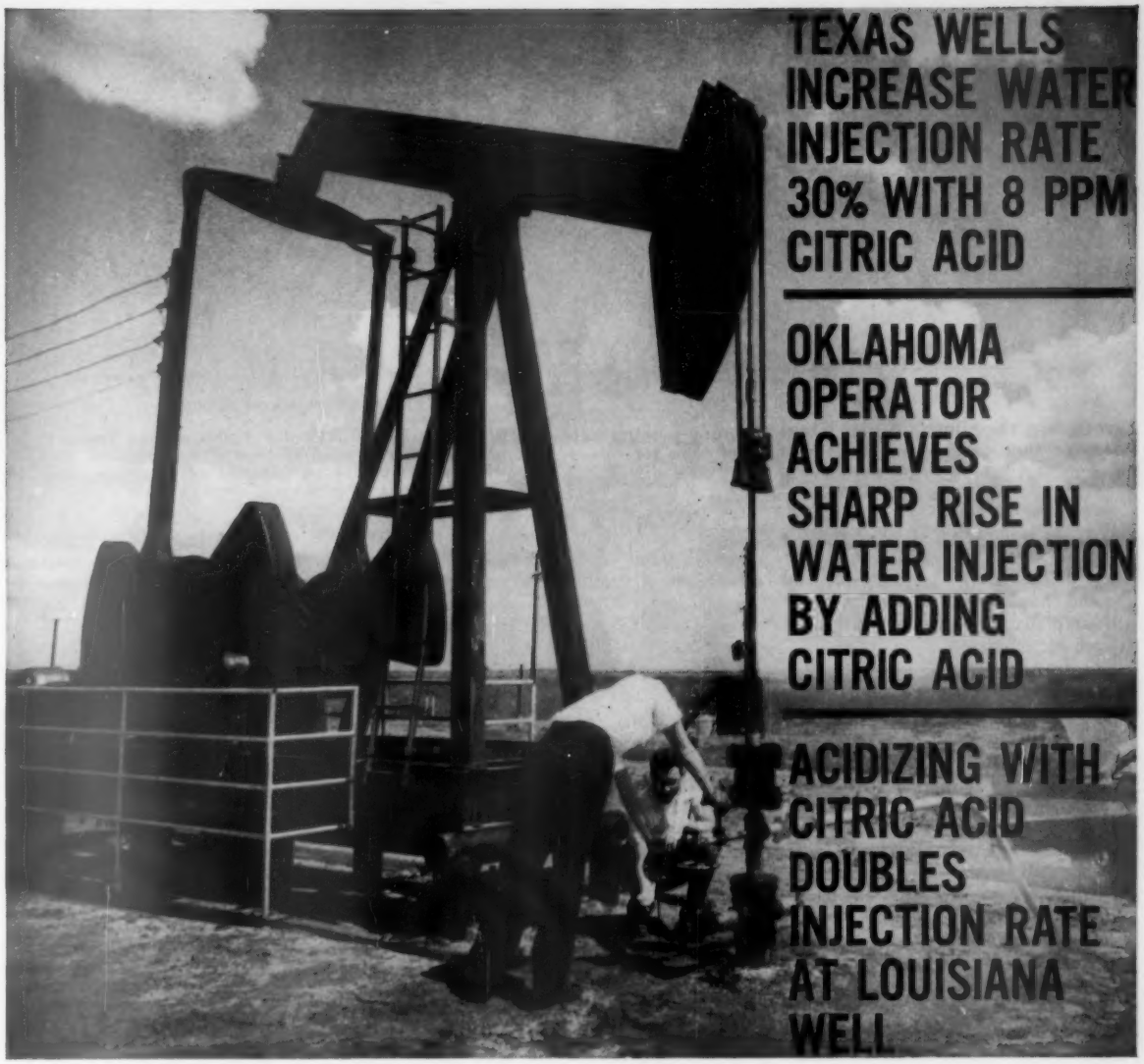
This interpretation will be valid



CALCULATED POSITIONS for homogeneous element of five-spot pattern of injection fronts of tracer slug at various times. Fig. 4.



PERCENTAGE AREA OR VOLUME swept out with respect to time for homogeneous five-spot pattern. Fig. 5.



TEXAS WELLS INCREASE WATER INJECTION RATE 30% WITH 8 PPM CITRIC ACID

OKLAHOMA OPERATOR ACHIEVES SHARP RISE IN WATER INJECTION BY ADDING CITRIC ACID

ACIDIZING WITH CITRIC ACID DOUBLES INJECTION RATE AT LOUISIANA WELL

● Citric acid is making news at water injection operations all over the country. Extensive tests carried out at well heads have proven this fact: citric acid can prevent plugging that is caused by iron precipitates in injection water.

At two salt water disposal wells in Southern Texas, with average injection rates of 200 to 400 barrels per day, maintenance treatment with an 8 ppm addition of citric was started. In a short time, a 30% increase in flow rates was noted.

A well in Oklahoma was experiencing lowered injection rates because of iron plugged sandface. The well was acidized with a solution of 260 pounds of citric acid, 25 gallons of Triton* X-100, 250 gallons of 15% HCl and 500 gallons of water. This treatment dissolved and sequestered iron responsible for plugging. Injection rate rose from 50 bbl water per day to 400 bbl per day at considerably reduced pressures.

A water flood operation in Southern Louisiana had such a concentration of iron precipitates that they could not, economically, be kept in solution. Two wells were treated with two 400 pound batches of citric acid each, two weeks apart. Combined injection rates more than doubled, from 4,000 to more than 8,500 barrels per day, at last report. Also, the injection pressure has averaged 300 psi lower than previous requirements. These results were better than any previously obtained with hydrochloric acid treatments.

Other operators using citric acid have noted good results because of less frequent downtime on filters, and less replacement of parts because of rusting.

If you have been experiencing problems caused by iron precipitation in your injection water, write Pfizer for full information on the use of citric acid for iron sequestering.

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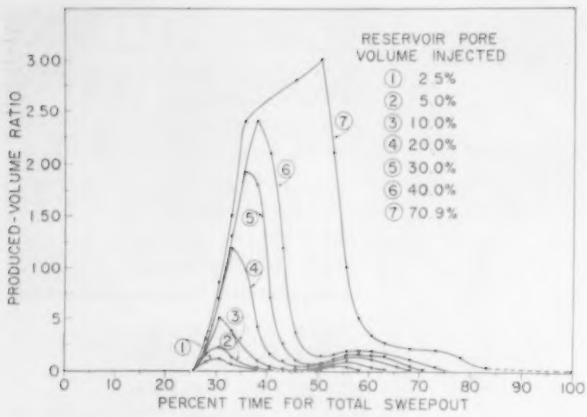
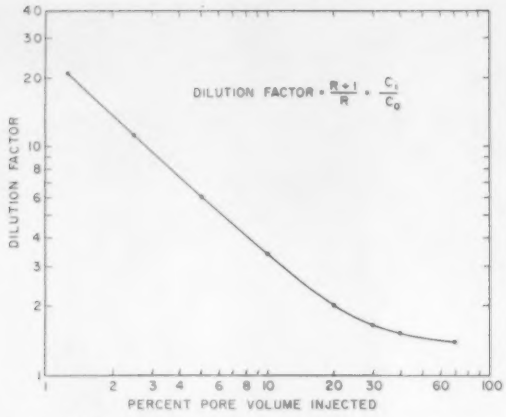


CALCULATED PRODUCED-VOLUME RATIOS of tracer-bearing fluid to barren fluid, as function of percentage of time for sweep-out, homogeneous five-spot pattern. Fig. 6.



DILUTION-FACTOR CURVE for homogeneous five-spot pattern showing relation of injected to produced concentrations at various percentages of reservoir pore-volume injections. Fig. 7.

only if the assumption of constant saturation is true. At best, the interpretation of first arrival times is qualitative and should be used in conjunction with core analyses, well tests, and subsurface measurements.

Use of curve . . . The principal use of the arrival-time curve is to determine the approximate upper limit of transit time between injection well and production well. The lapsed time between injection and detection is an important consideration when radioactive isotopes are used as tracers. The isotope selected must have a decay rate such that detectable amounts will remain at the time of arrival in the production well.

It has been shown in Fig. 6 that the maximum concentration of tracer in the produced fluids varies with the injection volume and the time after injection. The concentration necessary for detection, as determined by the sensitivity of the detection apparatus, determines the amount of tracer to be injected, the injection time, and the time after injection that the limiting concentration will be detectable in the production well. The relation of these factors for any given situation can be determined by using Fig. 6.

As an example of the use of the produced-ratio curves, assume that a five-spot pattern requires 50 bbl. of fluid to be equivalent to 2.5% of the pore volume available for injected fluid and that the detecting apparatus sensitivity is such that the output concentration of a radioactive tracer should be at least 40 microcuries per barrel of produced fluid. From Fig. 6, the maximum produced ratio obtainable from a slug volume of 2.5% of the total effective volume is 0.125 bbl. of tracer-bearing fluid per barrel of barren fluid.

Using this ratio and the cited sensitivity of the detection apparatus, the required tracer concentration at injection can be calculated to equal 360 microcuries per barrel of injected fluid, or 18 millicuries in the required 50 bbl. of fluid. Knowledge of the injection rate permits injecting the tracer over the period of time necessary to inject 50 bbl. of fluid.

Similar calculations and predictions can be made using a combination of information derived from Fig. 6, injection and production rates, permeability profiles, or other tests.

Conclusions

The analysis based on homogeneous physical conditions has been shown to be potentially useful in predicting arrival times at a production well of any injected tracer and the relationship between the concentrations of injected and produced tracer. The results of a graphical solution of the basic flow equation showing the relationship between reservoir parameters and first arrival times at the production wells has been presented.

These results should be useful in determining the expected arrival time at the production well of any injected tracer, selecting the proper radioactive isotope to be used as a tracer, and qualitatively interpreting relative arrival times at the various wells.

The relationship between the concentrations of injected and produced tracer, slug volume, and optimum time of detection after injection has been represented as produced-tracer-ratio curves. These curves may be used in determining the optimum amount of tracer and the period of injection so that detectable concentrations will be present in the various production wells.

Quantitative interpretation of actual field curves is possible through comparison with theoretical curves similar to those shown here for a five-spot pattern. The lack of adequate field data at present prevents any discussion of quantitative interpretation techniques other than those that can be deduced by direct comparison between field curves and theoretical curves along with other reservoir or performance data.

However, it appears that deviation of actual flow patterns from those predicted by using the described method, assuming homogeneity, may provide information of practical value regarding reservoir heterogeneities and thereby add to the basic knowledge of reservoir mechanics.

Acknowledgment

The authors express their appreciation to J. P. Govier, University of Missouri School of Mines and Metallurgy, and R. V. Higgins, U. S. Bureau of Mines, for their helpful suggestions and criticisms concerning the paper.

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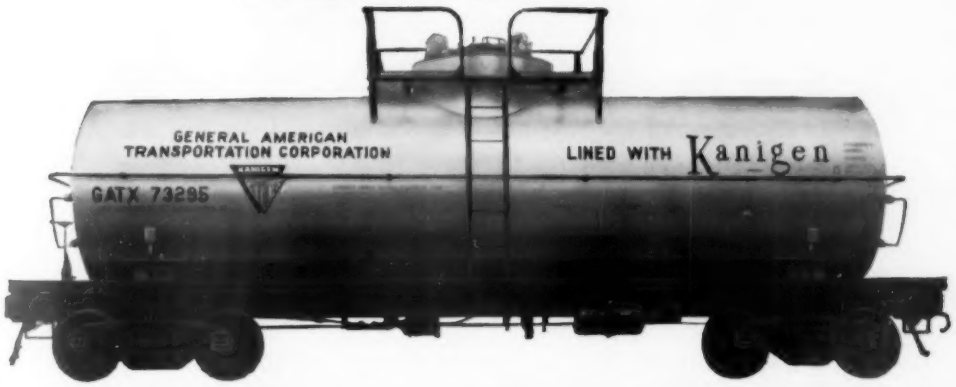

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A target date of January 1 has been set to have the first production sealed-bearing bits available for distribution in the type RG-1J, 8¾″ size. With regard to the other sizes in the insert series, and as to other types and sizes, distribution will be at the earliest date they can be produced, consistent with the Hughes policy of thoroughly testing each design before it is released to the field.

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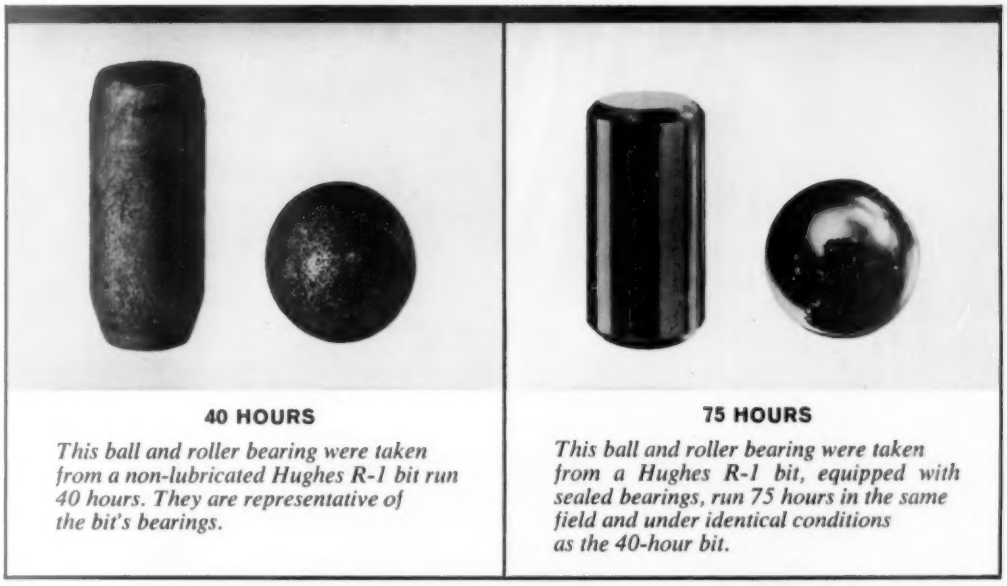

40 HOURS

This ball and roller bearing were taken from a non-lubricated Hughes R-1 bit run 40 hours. They are representative of the bit's bearings.

75 HOURS

This ball and roller bearing were taken from a Hughes R-1 bit, equipped with sealed bearings, run 75 hours in the same field and under identical conditions as the 40-hour bit.

These photographs are unretouched. The irregular shadows you see in the bearings (above right) are the camera and lights reflected by the mirror-like surfaces of the bearings.

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Oil-base mud passed test in deep, hot hole

By J. P. MacEACHERN
Shell Oil Co.
and AL SEAMAN
Oil Base, Inc.

SHELL OIL CO.'s 5 Rumberger in Elk City field, Beckham County, Oklahoma, bottomed at 24,002 ft. to become the deepest well in that state and the second-deepest in the world. One of the most interesting features of this drilling feat was the use of oil-base mud to combat the problems posed by the deep hole and its high temperature.

Oil-base fluid was used from 20,120 to 24,002 ft. It proved to be a stable system relatively easy to maintain; it increased hole stability and reduced mud costs. As a result, this mud can be called a success in the job.

The oil-base mud was used to drill the Shell 5 Rumberger from the base of the 7-in. liner at 20,120 ft. to total depth of 24,002 ft. Drilling and coring this Morrow and Springer series with 5-11/16-in. o.d. diamond bits required 140 days of operating time.

Lime-base mud had been used to a depth of 20,120 ft. But, it was beset by high-temperature gelation to the extent that drill pipe had been plugged and stuck, and there was difficulty in getting to bottom with logging equipment and bits. After displacing the lime-base mud with oil-base mud, the hole was more stable and no particular mud problems arose even at temperatures up to 360° F.

Total net cost for the oil-base mud system on this job amounted to $40,000, or about $285 per day or $10.30 per foot drilled. Compare this mud cost with the maintenance for the 13.5-lb. per gal. lime-base mud used over the 140-day period to changing to oil-base mud. It amounted to approximately $110,000, or about $785 per day, or $19.50 per foot drilled. Thus, this specific oil-base-mud system saved $70,000 or $500 per day, assuming maintenance costs for the lime-base mud would have remained the same had it remained in use.

Fig. 1 compares cost of the two muds.

Interpreting gamma ray, neutron, induction, and velocity logs was no more difficult than similar logs run in water-base muds. Mud logging was satisfactory using an infrared analyzer gas chromatograph and a wheatstone bridge.

Water-base troubles . . . Wells drilled with water-base muds in many areas of southern and western Oklahoma have much hole trouble through long sections of Morrow and Springer shales. Sloughing of these shales has been common, resulting in drill-pipe sticking, hole fillup, and hole enlargement. Besides, cost of mud maintenance mounts through these sections as the mud becomes contaminated by low-gravity-shale solids.

It was decided to use oil-base mud after a high solids content aggravated the problem of the lime-base oil-emulsion mud gelling at high temperature. First proof that the 13.4-lb. per gal. lime-base mud was gelling came while making a trip at 16,608 ft. The drill pipe became stuck. When it was freed, it was discovered that 16 of the drill collars were plugged with congealed mud. Temperature at this depth was recorded as 270° F. Prior to the sticking of the drill pipe, there had been some difficulty in reaching total depth with logging equipment and in getting back to bottom with the bit on trips.

After solids content was reduced, the mud properties were maintained satisfactorily to 20,120 ft. However, maintenance costs were high and the risk of further gelation of the lime-base mud remained. This discouraged its use after setting a 7-in. o.d. liner at this depth.

Oil-base fluid picked . . . Black Magic Supermix was selected as the drilling fluid below 20,120 ft. in an effort to (1) improve hole stability, (2) alleviate mud problems due to high temperature, (3) reduce mud maintenance costs, and (4) retain lithological and reservoir interpretation and evaluation methods.

The oil-base mud selected is a synthetic drilling fluid containing a special-type air-blown asphalt mixed with a refined oil, and specific peptizing and emulsifying agents to stabilize weight and control extraneous water. A light refined oil is used for viscosity control, and barite for density.

This mud does not contain or take into solution clays, bentonites, salt, gypsum, cement, or other common mud contaminants. Thus is eliminated the problem of high-temperature gelation and the difficulties of maintaining a mud with such contaminants. This mud deposits a thin (1/64-in. API tester) wall cake and can be maintained with a zero API fluid loss. Prior to the Rumberger, it had been used in successfully drilling two other wells[1 2] below 20,000 ft. with recorded bottom-hole temperatures as high as 389° F.

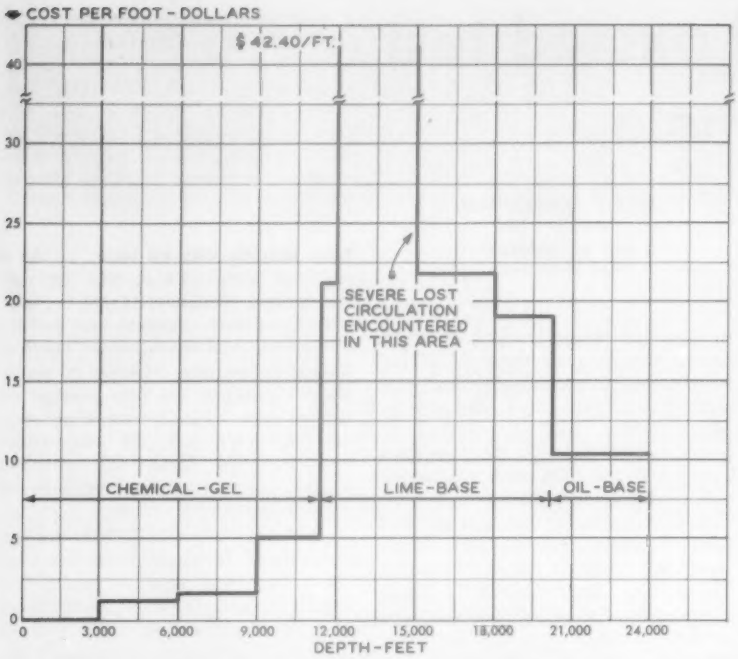
Hole stability with oil base . . . As a result of using oil-base mud through the interval 20,120 to 24,002 ft., hole conditions were excellent and drilling operations were trouble-free. The following factors are evidence of stable hole conditions: (1) free passage of drill pipe on trips, (2) ease of recovering drill pipe fish, (3) successfully reaching total depth with wire-line logging instruments, and (4) lack of trouble in running a liner.

Trip time below 21,150 ft. was approximately 15 hours. A double-elevator system was used to protect the notch-sensitive 4½-in. o.d. drill pipe. This increased the trip time by about 1½ hours over the time normally required using conventional slips. During these trips, normal drag was 20,000 lb. This drag was not considered excessive because bits remained on bottom as long as 176½ hours between trips, thereby allowing ample opportunity for filter cake to build up. However, because the oil-base mud was maintained with a zero fluid loss, it prevented the wall cake from becoming overly thick and troublesome.

Finally at total depth of 24,002 ft. it took 67 hours to perform wire-line logging operations. Five separate instruments with a maximum outside diameter of 4½ in. were run to total depth without any indication of shale, drill cuttings, or weight material having settled to bottom or bridged.

Temperature effects . . . Bottom-hole temperatures up to 360° F. were measured but these had no adverse effect upon the stability of the oil-base mud system. The viscosity of true oil-base mud decreases as temperature increases; however, this decrease is offset to some extent by pressure forces, which tend to increase viscosity. The over-all effect is a decrease in viscosity and gel values and an improvement in downhole hydraulics due to the influence of temperature on flow properties of the mud.

This inherent characteristic is a distinct advantage in mud pumpability and minimizes the likelihood of induced formation fracturing while running tools. And, as evidence of this, pump pressures to establish circulation on the 5 Rumberger even at

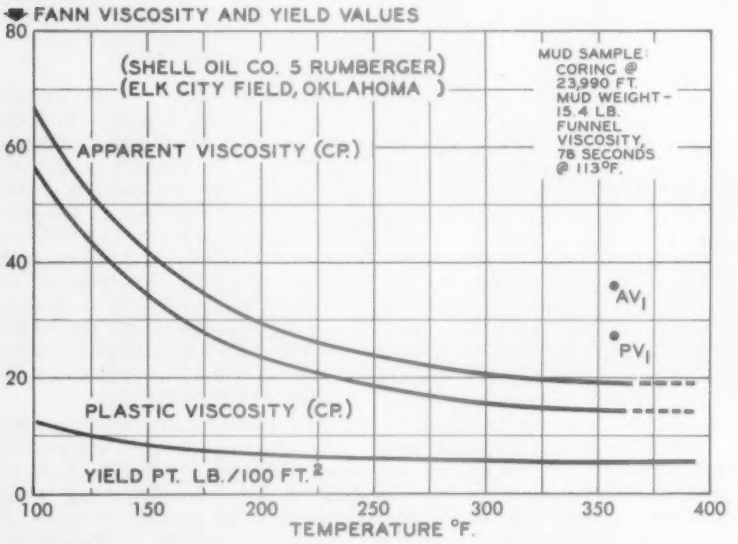


MUD COSTS for drilling Shell's 5 Rumberger decreased appreciably when the switch was made from lime-base to oil-base mud at depths below 20,000 ft. Fig. 1.

depths below 23,000 ft. rarely exceeded 500 psi.

Fig. 2 shows flow property versus temperature relationships at atmospheric pressure on a mud sample taken while coring to total depth. Data published by Sage and others[3,4] show that the viscosity of an oil increases 12-20% with each 1,000-psi. pressure increase. Using this approximation applied to the viscosity-temperature curve in Fig. 2, point AV_1 is the estimated bottom-hole apparent viscosity and point PV_1 is the estimated bottom-hole plastic viscosity. From this, the viscosity of the 15.4-lb. per gal. oil-base mud at 360° F. and 24,000 ft. appears to be 50% less than measured at flow-line conditions.

Mud costs low . . . Total **net** cost for the system used for drilling amounted to $40,000, or about $285 per day or $10.30 per foot drilled. Costs for the initial system of 1,600 bbl. of 13.5-lb. per gal. mud plus makeup volumes and maintenance resulted in a **gross** cost of approximately $77,000. Mud weight was raised to 15.4 lb. per gal. during the 140 days the mud was in use for drilling. At the end of drilling operations there were 2,200 bbl. of 15.4-lb. per gal. mud with a salvage value of $37,000.


FANN VISCOSITY AND YIELD VALUES
(SHELL OIL CO. 5 RUMBERGER)
(ELK CITY FIELD, OKLAHOMA)
MUD SAMPLE: CORING @ 23,990 FT. MUD WEIGHT - 15.4 LB. FUNNEL VISCOSITY, 78 SECONDS @ 113°F.
APPARENT VISCOSITY (CP.)
AV1
PV1
PLASTIC VISCOSITY (CP.)
YIELD PT. LB./100 FT.2
TEMPERATURE °F.

FLOW PROPERTIES of oil-base drilling mud used on the 5 Rumberger. Fig. 2.

Logging . . . Oil-base drilling fluid is electrically nonconductive. Consequently it requires logging by methods other than those which depend upon the conductivity of the drilling fluid to extend the electrical field either to the formation or to the grounding medium. The logs which may be used in oil-base mud include gamma ray, neutron, induction, and velocity surveys. These logs present a family of data for stratigraphic correlation, lithology, porosity determination, and oil and water saturations. Non-electrical-type surveys such as temperature logs and caliper surveys can also be run in oil-base mud.

It is felt that it is no more difficult to interpret logs run in the oil-base-drilled section than those run in water-base muds. Evaluation was made on the basis of gamma ray, neutron, induction, and velocity logs.

Mud logging . . . The mud-logging unit on 5 Rumberger used separate methods for detecting hydrocarbons entering the mud system. The methods included (1) the wheatstone bridge or hot wire, operating on the principle of catalytic combustion of gases extracted from the mud, (2) the infrared analyzer, operating on the principle of absorption of light waves of a given wave length by methane, and (3) the gas chromatograph, operating on the principle of absorption of hydrocarbons on hexadecane impregnated fire brick and the selected release of these hydrocarbons according to their partial pressure and molecular weight.

There was no problem in detecting entrained formation gas in the oil-base mud. As background gas and trip gas varied, it was necessary to adjust the sensitivity of the detecting devices. Such procedures, however, are common when drilling with water-base muds.

Gases in the mud had a concentration of less than 1% to more than 80% methane in air. A reversal of the hot-wire readings was observed when detection by infrared analyzer indicated the per cent methane in air to be greater than 40.

Drill cuttings were cleaned by washing in diesel oil and then in detergent. Such procedure impaired hydrocarbon detection somewhat but was necessary to determine lithology.

Casing and bits . . . Here is an outline of the pipe programs in the well:

Casing Data

20 in. at 200 ft.
13⅜ in. at 3,086 ft.
9⅝ in. at 11,505 ft.
7 in. liner at 20,120 ft.
4½ in. liner at 21,931 ft.

Drill-Pipe String

0-11,500 ft.	5-in.	19.5 lb./ft.
11,500-18,500 ft.	4½ in.	16.60 lb./ft.
18,500-20,100 ft.	4½ in.	16.60 lb./ft.
20,100-24,000 ft.	4½ in.	16.60 lb./ft.
	3½ in.	13.30 lb./ft.

Except for four conventional rock bits, diamond bits were used to drill the 5-11/16-in.-diameter hole below the 7-in. liner to the coring point at 23,950 ft. Through this interval, 34 diamond bits were used with an average penetration of 116.5 ft. per bit. Average rotating time per bit was 64 hours. Drilling rates ranged from 1 ft. per hour to 2¼ ft. per hour.

The diamond bits showed varying amounts of wear reflecting difference in individual bit design and, to some extent, type of formation drilled. It is difficult to determine just what influence the lubricity of the oil-base mud had on bit life because no comparable runs have been made under like conditions using a water-base mud.

The most satisfactory bit design was one with a relatively flat bottom drilling surface with water courses which tended to direct the mud across the entire face of the bit.

Penetration was maximum with 10,000 lb. on the bit, rotating at 45 r.p.m., and with a fluid volume of 135 g.p.m. Pump pressure of 3,000 psi. was required during this.

Coring and liner . . . Before final logging, two 25-ft. cores were cut from 23,952 to 24,002 ft. using a conventional 5-11/16-in. o.d. diamond coring bit. These are the deepest cores ever recovered, with recoveries of 83% and 100%. Coring time of the Springer marl averaged 20 minutes per foot compared to a penetration rate of 30 minutes per foot drilling with a 5-11/16-in. diamond drilling bit just prior to coring. Circulation rates were maintained at 120 g.p.m. at a surface pumping pressure of 3,000 psi. A pull of 5,000 lb. over drill-pipe weight was required to break the core. All phases of the coring operation were normal.

Two liners were set in the well. A 7-in. liner was set in an 8⅜-in. drilled hole at 20,120 ft. with fine-base mud in the hole, and a 4½-in. liner was set in the 5-11/16-in. hole drilled with oil-base mud. The hole was plugged back to 22,360 ft. and the 4½-in. liner set at 21,931 ft. in order to open-hole test a section below 21,931 ft.

Fishing operations . . . As a result of drill-pipe pin failures, there were four fishing jobs below 22,000 ft. The first two pin failures occurred while drilling at 22,467 and 22,708 ft. respectively. Each fish was recovered on a single trip with a 5⅜-in. overshot without the necessity of washing over.

The third and fourth failures resulted in a double fishing job. A pin failed while drilling at 23,516 ft. This reduced hook load by 98,000 lb. On the trip out of the hole, 44 stands of drill pipe had been pulled when another pin failed, dropping 3,366 ft. of 3½-in. drill pipe on top of the first fish. The upper fish was engaged at 11,420 ft. with an overshot and pulled without difficulty. The remaining fish, 8,730 ft. of 3½-in. drill pipe, and 4¼-in. drill collars were engaged with an overshot and worked free in 1½ hours.

References

1. "Records Broken by Independent Wildcat," World Oil, Oct. 1950.
2. Emery, W. B. II, **The Ohio Co.'s Deep Test Well, Paloma Field, Kern County, California**—API paper 826-26-D, presented at the spring meeting of Eastern District, API Division of Production, Pittsburgh, May 1955.
3. Sage, Sherbourne and Lacey, **API Production Bulletin No. 216** p. 40 (1935).
4. Muskat, M., **Physical Principles of Oil Production** p. 94-95 (1949).

BOOK

GROUND WATER HYDROLOGY, by David K. Todd. Published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16. 336 pp. $10.75.

This book is essentially a volume on finding and producing water, and only a casual mention is made of petroleum. The book points out that ground water in petroleum reservoirs will not be treated in the volume, but adds, "It should be noted, however, that groundwater hydrology has gained immeasurably from research conducted by the petroleum industry."

Nelson Refinery Cost Indexes

Published in the first issue each month in the Engineering Section.

Compiled by W. L. Nelson, Technical Editor and petroleum refinery consultant, Tulsa.

Charts of the indexes are published each year in a late January or early February issue.

Indexes of selected individual items of equipment and materials are also published on the Costimating page in the first issue of the month of January, April, July, and October.

Refinery Construction Cost Index (1946 Basis):

Explained on page 101 of the issue of August 5, 1957.

	1950	1954	1956	1957	1958	May 1959
Pumps, compressors, etc.	138.2	166.5	192.0	206.7	214.7	226.4
Electrical machinery	134.9	160.0	175.0	188.9	192.7	194.2
Internal-combustion engines	126.0	150.5	164.0	173.9	178.3	178.6
Instruments	127.8	154.6	182.1	187.4	194.9	204.1
Heat exchangers	140.0	171.7	190.7	203.6	181.2	176.4
Misc. equipment average	126.2*	160.7	180.5	192.1	192.4	195.9
Materials component	149.5	174.6	190.4	201.9	204.2	206.7
Labor component	144.0	183.3	198.2	208.6	220.4	228.7
Nelson construction index	146.2	179.8	195.3	205.9	213.9	219.9

*Used in computing the Nelson Index until April 1952.

Refinery Operating Cost Indexes (1956 Basis):

Explained on page 171 of the issue of June 1, 1959.

	1946	1952	1954	1957	1958	March 1959
Fuel cost	49.6	81.0	86.5	112.4	102.6	105.8
Labor cost	73.1	88.7	90.9	106.1	105.0	102.0
Wages	52.4	81.5	88.7	104.1	105.4	111.8
Productivity	68.3	90.2	97.1	98.1	100.3	109.6
Investment, maintenance, etc.	51.2	83.6	92.0	105.4	109.5	112.1
Chemicals cost	37.0	72.1	85.7	102.2	104.4	101.3
Operating Cost Indexes:						
Refinery	58.5	80.5	88.7	106.4	105.9	105.3
Process units	62.9	82.2	88.4	107.1	105.8	105.6

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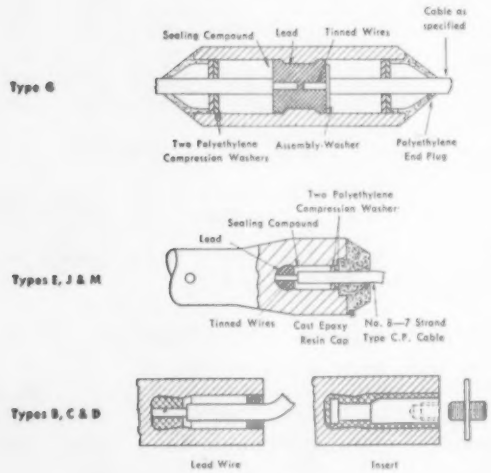

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B	1" x 60"	1.4	14	Fresh Water
C*	1½" x 60"	2.0	25	Ground Bed
D	2" x 60"	2.6	46	Ground Bed
E	3" x 60"	4.0	115	Salt Water
G	2" x 9"	0.4	5	Ducts
J	3" x 36"	2.5	80	Salt Water
M	2" x 60"	2.8	57	Salt Water

*Applicable also in fresh water service. Should not be used in ground beds without backfill.

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DURCO

Flash-point detectors are being used by Standard of Indiana for . . .

Product quality control

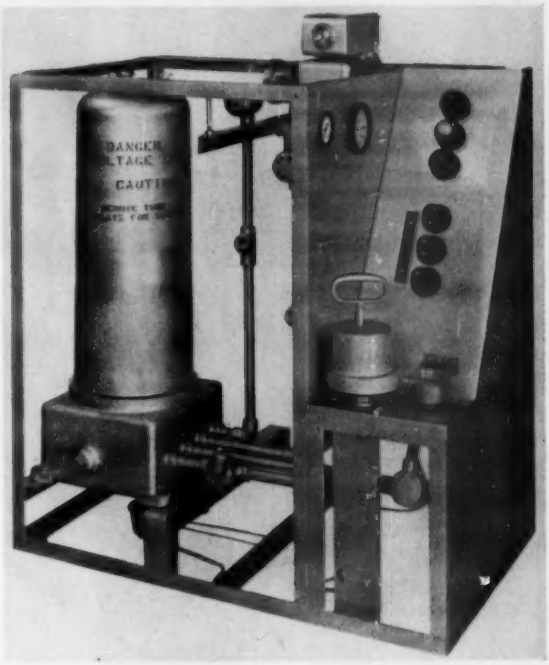
BY JAMES P. POLSTON
Superintendent, Products Movement
Supply and Transportation Department
Standard Oil Co. (Indiana)

"HOW do you keep the products separated?" This is a question which has probably been asked of products-pipeline people more than any other one question.

To begin with, it is absolutely necessary to maintain turbulent flow. In addition, some firms have used spacers of one type or another, such as a tight rubber-disked scraper, or an inflated ball. Another method is to use a flag, which is a small batch of a product mutually compatible to the products to be divided, which will be divided part to each of the products.

In most instances, however, neither physical nor fluid spacers are used. In this case, as with flags, an interface is formed which is a mixture of the two adjacent products. This commingled product will vary in quantity and quality dependent upon the nature of the two products. This, then, presents a new question: What is done with the mixture?

The disposal of the commingled product necessarily depends upon its nature. Where the two products are similar in nature, such as regular and premium gasolines, the interface would probably be put into the regular gasoline, thus losing money on the premium which is downgraded, but losing no quality in either. Between No. 1 and No. 2 fuel oils, where color is a prime factor, No. 1 would be cut to No. 2, thus losing some dollar value, but maintaining quality. The disposal of interface between oils and gasolines, however, is another matter. Here is where flags ordinarily come onto the scene.



FLASH TESTER at loading rack checks whether product is safe to sell.

Determining Cut Points

The most critical factors to be watched, where mixtures of oils and gasolines are concerned, are octanes on the gasoline and flash points on the oils. Since octane measurement is a laboratory procedure not economically adaptable to everyday usage at field-terminaling installations, the more common technique is the measurement of end points.

This procedure uses a still in which small quantities of the fluid to be tested can be raised in temperature until all the material has evaporated. The maximum temperature required to evaporate all of the sample is known as the "end point." This is to some degree indicative of the octane deterioration which would take place if large quantities of heating oils were to be mixed into gasolines. The time to test a sample, however, is too great to allow such a procedure to be used in pipeline control.

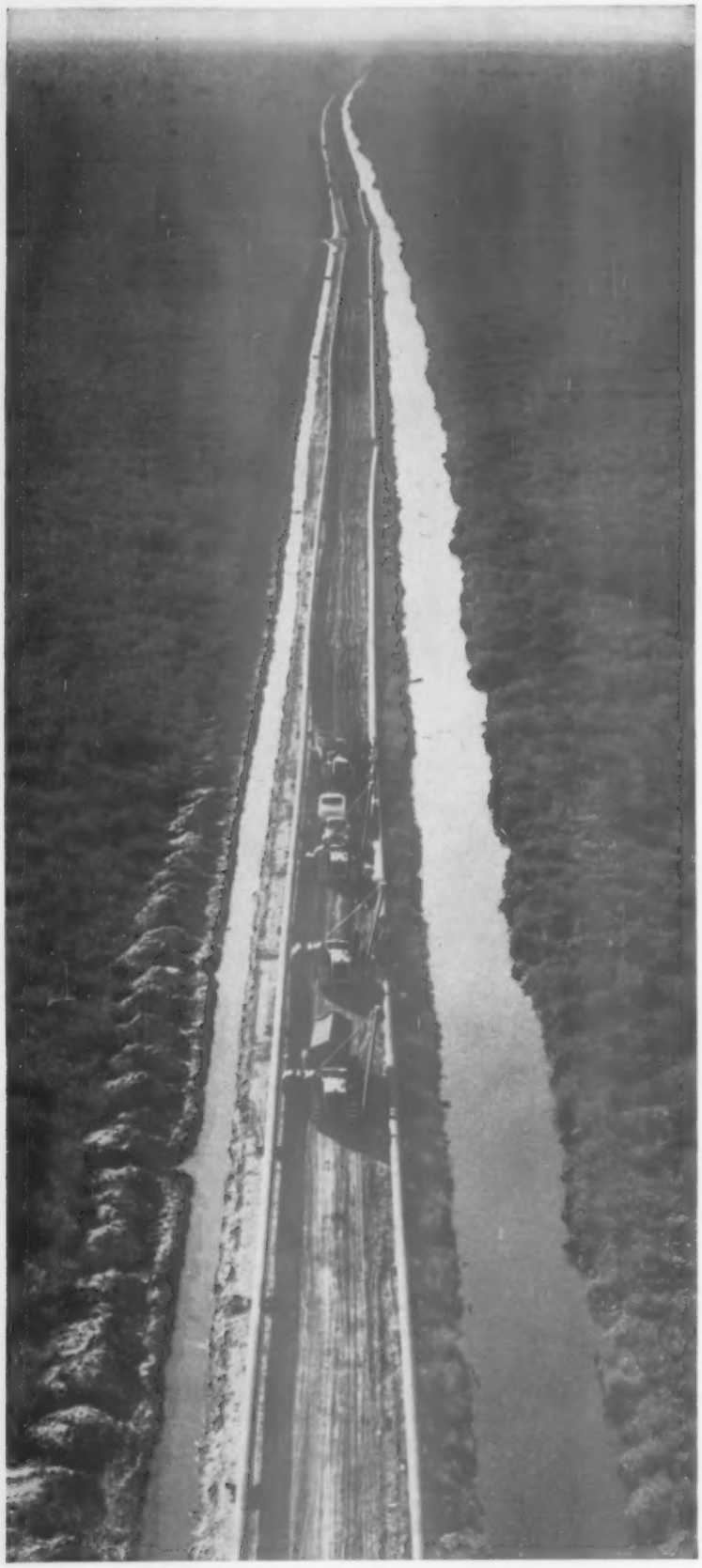
The flash point is the temperature at which any product will vaporize sufficiently to ignite if exposed to flame. In the case of gasolines, for example, the flash point is approximately —30° F. The acceptable minimum on household kerosine, on the other hand, is approximately 120° F., with other heating oils in the same neighborhood or higher.

Cut limitations . . . Generally speaking, less than 0.25% of one type of product can be safely mixed into the other, and in some instances none. Jet fuel, for example, can tolerate no leaded gasolines, requiring an absolutely pure cut if pumped next to such gasolines. Other products are similarly susceptible to limitations dependent upon their nature. The limitations of mixture being what they are, distinguishing one product from the other is a critical matter.

The similarity of the products, however, makes it extremely difficult to distinguish one from the other in a flowing pipeline. Some firms are using radioactive tracers injected in the interface to determine where to cut. Others determine cut points with gravitometers, dielectric measuring devices, and in our case, flash-point measuring devices. We use the hand-sampled gravity and color determination on the whole, but are successfully using automatic flash-testing devices at two locations.

Before delving into the various fea-

From a paper presented at University of Oklahoma Automatic Control Conference, Norman, Okla.



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tures of the automatic flash testers, let us review the ASTM standardized manual procedures. The Tag Closed Cup method, described in the ASTM manual on petroleum products in Section D-56-36, is used on fuels with flash points under 175° F. The Pensky-Martens method, described in Section D-93-46, is used on heavier fuels, lubricating oils and asphalts.

Basically, the two procedures are similar, in that a sample of oil is slowly heated from below its flash point and exposed to an igniter flame at preset intervals. The temperature at which the product ignites is the flash point. The basic difference in the two methods is that the Tag Closed Cup method entails heating a water bath into which the sample cup is placed, whereas the Pensky-Martens tester heats the sample cup directly.

Automatic Flash Testing

The devices which have been developed for automatically testing various heating oils follow a procedure not unlike these two manual methods. In each instance a sample of oil is raised in temperature and exposed to a spark igniter at a preset interval until ignition occurs. There are five different types of these testers now in use in our company.

The first type, of which there are more installations, is a "Go-No Go" type used at the loading racks at our major terminals and refineries. It is used to test liquids which flash at temperatures between 110° F. and 140° F. at any preset point within the range. It is used to test samples taken from transport trucks as a double check to make sure that each load is safe to sell. Since transport trucks carry many different products, contamination could occur if the driver did not get absolute draindown of his compartments. Hence the double check.

Operation of the loading-rack flash tester is very simple. The loader places a small amount of product in the sample cup and turns the device on. The testing chamber is flushed with the product, and a small amount is left in the chamber. This is then heated to a predetermined acceptable temperature, while being exposed to an igniter spark at preset intervals. If ignition takes place before the maximum acceptable temperature is reached, the sample is rejected.

At this point a red light goes on on the front panel. If the product tests O.K., then a green light is turned on on the front panel, and an acceptable - product stamping device is actuated, allowing the loading ticket to be so stamped. Once a ticket has been stamped, the remaining product is flushed from the sample cup, thus allowing only one ticket to be stamped per sample. This test requires 2½ minutes, as compared to a 20-minute manual test, and is accurate to within ±1° F.

The second type of automatic flash tester used is a laboratory type. This device records on a chart the full course of the test temperature range, and is accurate to ±2° F. Since this device is not to be used under similar conditions as the loading-rack tester, it has not been made explosionproof. And since varying flash points are to be observed, another change is required.

This unit incorporates a water-bath enclosed test chamber, heating and cooling the chamber with alternately hot and cold water. It is used to test fluids below 180° F. Cooling time is approximately 30 seconds. The time for a test on this device is 2½ to 4 minutes, requiring less than 1 minute of an operator's time, but allowing only 12 to 20 tests per hour. This is not important with respect to this device, but it is a factor of much importance in others.

The third type of automatic flash tester is a continuous flash-point recorder. This is an explosionproof device for use in refinery-process control, which takes samples from a flowing stream and tests them automatically at 3-minute intervals. The recording chart, which is not explosionproof, would be mounted in the control room, or at another nonhazardous point. The range on this instrument is 80° to 190° F.

In this device the product flows through the test cup continually, with the test stream being slowly raised to the flash point by a preheater. After flash, the flowing product is cooled by a water-cooled heat exchanger, thence cooling the test chamber. The cooling period is 2 minutes. This instrument also has an accuracy of ±2° F.

Pipeline control would be difficult with these three types of flash testers. The loading-rack type and the laboratory type both require that the samples be hand poured into the sample cup. In addition, the time to test a sample with all three is too long to be of use in making a product cut.

The rate of flow in products pipelines varies from 100 to 4,000 bbl. per hour, and higher. But points between products, to be truly efficient, should be accurate to the nearest 10 to 20 bbl. This means that an accurate cut point should be determined to the nearest 3 minutes at low flow rates to as low as the nearest ½ minute on faster flowing streams. Thus,

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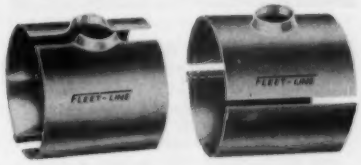

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there are three critical items which must be watched very closely:

1. Speed at which product stream is flowing.
2. Distance between test point and cut point.
3. Time to run product test.

All of these point to one thing: that any test, to be effective, has to be correlated with the flowing stream. This is one point which is the easiest to miss. It is also the hardest to instrument into pipeline design.

The fourth type of tester is one which is being successfully used in making cuts at an end-point terminal on our pipeline system. This device is a continuous flash-point recorder, which has been modified to speed up the test time. It uses a refrigerated cooling cycle, which cools a water-bath-type test chamber in 6 seconds. The heating cycle is also speeded up by using a hot-water heater which is continuously on, maintaining a high-temperature water source for the heating cycle.

Switching between these two is effected by a three-way solenoid, which diverts a continuous-flowing water-bath stream from one cycle to the other. As you can see, this device in some ways resembles the laboratory tester, and in other ways the continuous flash-point recording tester which was previously discussed. Accuracy is ±2° F., with a test cycle 45 seconds in length. This device is used by observation only.

The fifth type of tester is a modified loading-rack tester, piped up to provide continuous testing of a flowing stream. This Go-No Go tester is used as a control device at a takeoff location in one of our pipelines. Here there are two takeoff lines, one for gasolines and one for oils. The tester is located on a bypass line between the two, in a control house.

Before distillates or high-flash product can be taken from the pipeline, a bypass pump comes on, and the flash tester samples the product. The product must test good at the beginning before the terminal can be opened in from its remote-control point, and it must not flash during the entire takeoff period or the flash tester will close out the line. This device is accurate to ±1° F., and its extreme accuracy has served well.

All in all, we have found the flash-point detection instruments to be exceptionally good investments in maintaining product quality at our many terminaling locations. The devices described in this paper were developed by the Standard Oil Co. (Ind.), and the first three are now being marketed under license by the Precision Scientific Co., of Chicago.

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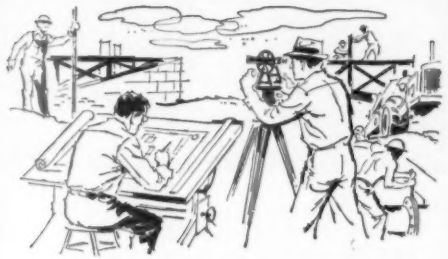

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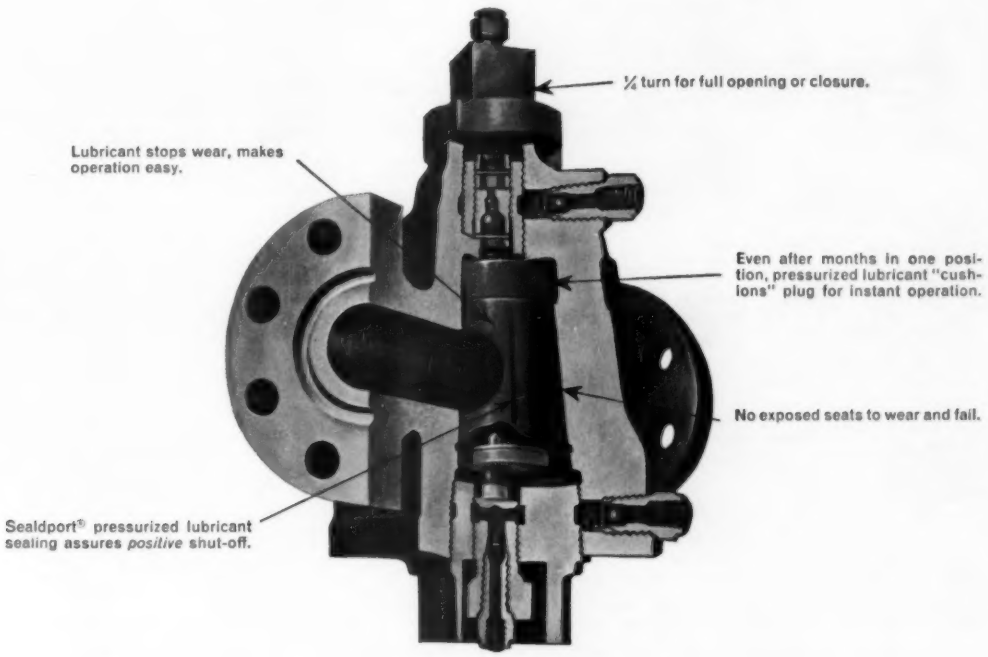
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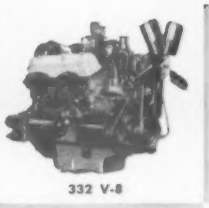
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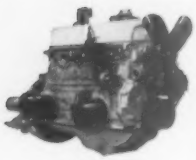
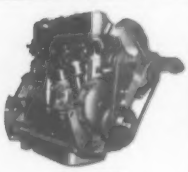

223 6-CYL.

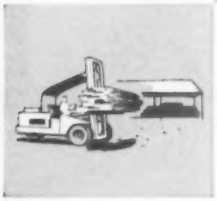
172 4-CYL.


134 4-CYL.

330 DIESEL 6-CYL.

220 DIESEL 4-CYL.

NOW...TEN FORD INDUSTRIAL ENGINES TO MEET YOUR POWER NEEDS!



Whatever your application, consider the many advantages you get with a Ford Industrial Engine.

Completely modern throughout, all Ford engines have Short Stroke design for increased operating economy . . . overhead-valve construction for quick, easy servicing . . . and provide more horsepower per pound of engine weight than ever before possible. To cut costs on *big* jobs, Ford offers 3 new Super Heavy Duty V-8's with totally new lubrication-, cooling-, and fuel-systems.

Ford Industrial Engines range from 134 to 534 cubic inches . . . including two Diesels. All are available as engine assemblies or power units, and can be fitted with Ford-approved attachments such as SAE housings, torque converters, transmissions and other equipment for special operating needs.

What's more, Ford users enjoy a minimum of downtime because there's always a Ford Dealer nearby with a complete stock of the more commonly purchased replacement parts. Yours at low Ford prices.

Get the *right* power for your application. Check Ford's full line of 4-, 6-, and V-8-cylinder engines soon.

INDUSTRIAL ENGINE DEPARTMENT • FORD Division of FORD MOTOR COMPANY
P. O. Box 598, Dearborn, Michigan

YOUR JOB IS WELL-POWERED WHEN IT'S FORD-POWERED!

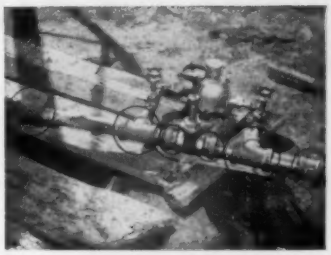
▶ ▶ ▶ New Equipment Section

This week's SHOWCASE features . . .

Threadless pipe fittings save time

. . . and offer a way to cut expenses in installation of low-pressure pipe. An advantage of the pipe fittings is that no special tools are needed for installation and no special preparation of the pipe is required, such as threading, grooving, flaring, or soldering. The fittings can also be used over again.

The fittings can be used for tank-battery hookups, drilling fuel and water lines and pipe repairs. An internal clutch ring and rubber gaskets are used. A connection is made by slipping the fitting over the pipe ends and tightening the end nuts. Made of malleable iron, they come in sizes



from ½ to 2 in. Working pressure ranges at the maximum from 300 psi. for the 2-in. fitting to 1,000 psi. for the ½-in. fitting. SOURCE: **Continental-Emsco, Dept. OGJ, Box 359, Dallas.**

Mast designed for fast rigup

. . . for well-service work, workover, and drilling is now being produced that is a telescoping type fabricated in two sections to take the place of double-pole telescoping masts. Only two internal guys are required. This can be an important advantage over poles using deadmen, particularly in cap-rock country, the maker points out.

No auxiliary or hydraulic equipment is needed to raise the Fedco mast. The same crown block, leveling screws, raising line, and sheaves used on a pole mast can be used on the mast. When extended in the operating position, the mast's over-all height is 65 or 69 ft. from ground to bottom of crown block. With four lines to the traveling block, the mast has a static hook-load capacity of 90,000 lb. with A-7 angle legs, and 135,000 lb. with Manten angle legs. The 65-ft. mast weighs about 6,100 lb. and the 69-ft. mast, 6,500 lb. SOURCE: **Fedco, Dept. OGJ, 4712 Selkirk Drive, Fort Worth 9.**

●

Redesigned taper mill available

. . . now can be used to mill out collapsed casing, enlarge holes through adapters or retainers, mill out dented or mashed area of casing, and, with permanent whipstocks, to clean out and remove burrs from windows. The taper mill is dressed with Servcoloy, a patented method of using tungsten carbide in drilling, milling, and fishing tools. Bits of carbide are suspended in a tough, elastic matrix to give hundreds of cutting edges that are always in contact with the surface being cut. SOURCE: **Servco, Dept. OGJ, 2450 Cerritos Avenue, Long Beach 6, Calif.**

●

Pump cavity for rodless pumps

. . . has been developed and field-tested. The cavity is a closed power-oil, parallel, free-hydraulic-pump type with a stab-in crossover assembly. Run in on 2½-in. tubing, the cavity permits 1¼-in. parallel tubing strings for power oil return and production return to be run individually and stabbed-in to seal off.

The maker reports time savings of 30 to 50% are achieved over a simultaneous run-in of the conventional three strings. Too, the need for clamps on every joint is done away with. And trouble in one string does not require the pulling of all three. The concave upper face of the tool insures proper placement and seating of the tubing strings which are locked in place. SOURCE: **Sargent Engineering Corp., Dept. OGJ, 2533 East Fifty-sixth Street, Huntington Park, Calif.**

Send this **Showcase Coupon**

to the Manufacturer of the item in which you are interested. See name, address, and equipment name and/or model, in bold-face type at end of description.

NAME AND/OR MODEL NUMBER.....

.....

Described in OIL AND GAS **JOURNAL** - **Issue of September 7, 1959**

NAME.....**TITLE**.....

COMPANY.....

ADDRESS.....

CITY.....**STATE**.....

FORT WORTH, TEXAS

SUBSIDIARY
OF BELL AIRCRAFT
CORPORATION

BELL
Helicopter
CORPORATION

SAVED BY THE BELL:

time, money and sometimes lives

The crew boat has earned its stars. So have the jeep, truck and marsh buggy. But times have already changed. Right now, if you travel the shorelines or wherever else oil is being hunted, what catches your eye are the neat bullseyes, sometimes in the midst of nowhere. Then if you wait awhile, you'll see a Bell come in and set down, as indifferent to the wilderness as a wasp.

Usually, while rotors are still whirring, several husky men will get out and several more will climb aboard. Or you'll see them load something in a crate, marked RUSH. And sometimes they gently take off a litter, followed by a doctor. Then once again the Bell is gone.

Obviously oilmen use Bell helicopters because the machines save them money. A Bell is the most independent conveyance in the world. It goes anywhere, anytime, ignoring roads and runways, sand, salt grass, mountains or sea water.
But there's also something else. Oilmen will tell you — just to own one is to feel its total sense of freedom. A lot of people in the oil business — producers, geologists, geophysicists — have changed to the Bell. Maybe it's time you looked into it seriously.
Let us send you some facts about Bell operation and cost.
Just write Dept. 226I, Bell Helicopter Corporation, Fort Worth, Texas.
Why not now?

SHOWCASE . . .

New Equipment

B.s. and w. monitor for LACT units

. . . is built with transistors and printed circuits to achieve reduced size. The newly developed Model TDM dielectric monitor is a precision capacitance type. It gives a continuous record of the percentage of b.s. and w. in the flowing crude stream, if within the span of the recorder, even though contamination is beyond the shutdown point. Provided with a 31-day strip-chart recording, the instrument comes with either high or low-limit controls or both if desired.

Other noteworthy features include adjustable span control, zero elevation and suppression, voltage regulation, and temperature compensation. Accuracy is rated at better than 0.1% in terms of b.s. and w. SOURCE: **United Engineers, Inc., Dept. OGJ, 824 East Sixth Street, Tulsa.**

●

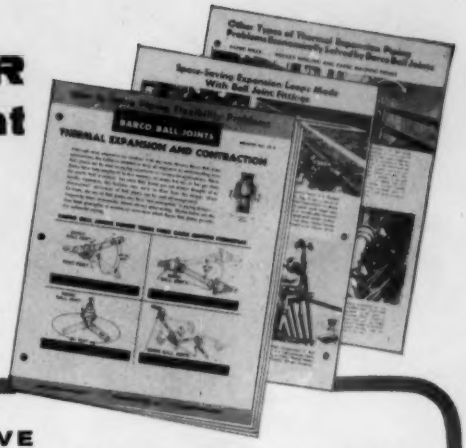
Efficient packer for single wells

. . . or dual completions with one zone through the annulus has just been announced. It can also be used as the bottom packer for dual, triple, quadruple, or quintuple parallel-string completions.

The maker cites a number of advantages for the HS-16-1 packer. The well is kept under positive control at all times because the wellhead is put into place before the drilling fluid is displaced or the packer set. Before the packer is set, complete circulation and cleaning of producing zones can be accomplished. Too, contact with the casing is unnecessary and conventional drag springs or friction blocks are not used.

Two slips, facing in opposite directions, enable the packer to withstand a high differential pressure from either side, a particularly valuable feature when acidizing or fracturing is necessary. SOURCE: **Brown Oil Tools, Inc., Dept. OGJ, 8490 Katy Road, Houston.**

EVERY ENGINEER will want these FACTS!



NEW EDITION
Bulletin No. 31-A

"HOW TO SOLVE

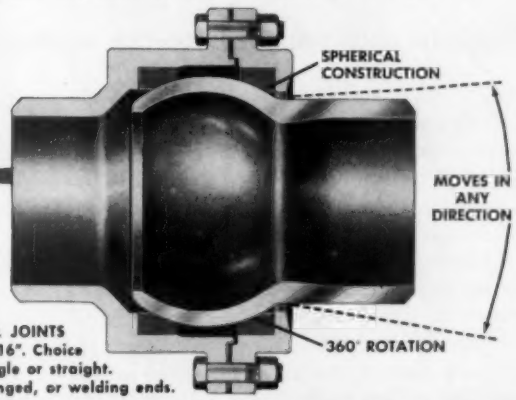
PIPE EXPANSION

PROBLEMS"

TODAY there is an easier way to accommodate *thermal expansion* in piping! No need to install special devices—in virtually every instance, you can put *flexibility* right in the line itself with standard BARCO BALL JOINTS:

1. **SUPERIOR METHOD.** New Steam Power Stations . . . Oil Refineries . . . Chemical Plants . . . Paper Mills . . . Office Buildings . . . Schools now are using this money-saving method.
2. **LONG LIFE.** No rubber, no thin metal members subject to fatigue or "blow-out." No lubrication, no grease packing. Self-adjusting; pressure sealing.
3. **FIRE-SAFE.** The joints have passed rigid fire, high temperature, and water quench tests.
4. **SAVE SPACE, CUT COSTS.** No pressure thrust — expensive anchoring or bracing not required to hold piping in place or in line. Cuts space required for pipe loops and U-bends.
5. **VERSATILE.** Easy to handle compound twisting movements, wide variations in temperature and pressure—steam, air, oil, water, gas and chemicals.

SEE your Barco Representative for information or write. Ask for the new revised Bulletin No. 31-A, "How to Solve Piping Flexibility Problems." *Engineering recommendations on request.*



BARCO BALL JOINTS
Sizes ½" to 16". Choice of styles, angle or straight. Screwed, flanged, or welding ends.

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In Canada: The Holden Co., Ltd., Montreal

New ways Liberty Mutual provides

Protection in depth

to safeguard your people... to cut workmen's compensation insurance costs

Anything you can do right now to cut down on accidents and losses on your jobs will help toward cutting your compensation insurance costs in the future. At Liberty Mutual, we can help you accomplish this by making available an unusually wide range of extra skills and resources.

This is Liberty's protection in depth. Some of its resources are pictured on these pages.

Protection in depth has helped thousands of Liberty Mutual policyholders save money through experience modification. And it has helped us return more than $491 million in dividends.

Now, oil-well drillers can get this same protection in depth from Liberty in a new four-way insurance plan. In addition to workmen's compensation coverage, this four-way plan gives you rig coverage to protect you against loss from fire, blowout, collapse and many other disasters. It also provides general liability coverage and fleet coverage for your trucks and cars.

Liberty's protection in depth can be yours today. Contact our nearest office for full details.

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Business Insurance: Workmen's Compensation, Liability, Group Accident and Health, Fire, Fleet, Crime, Rig

Personal Insurance: Automobile, Fire, Inland Marine, Burglary, Homeowners'

(Below)

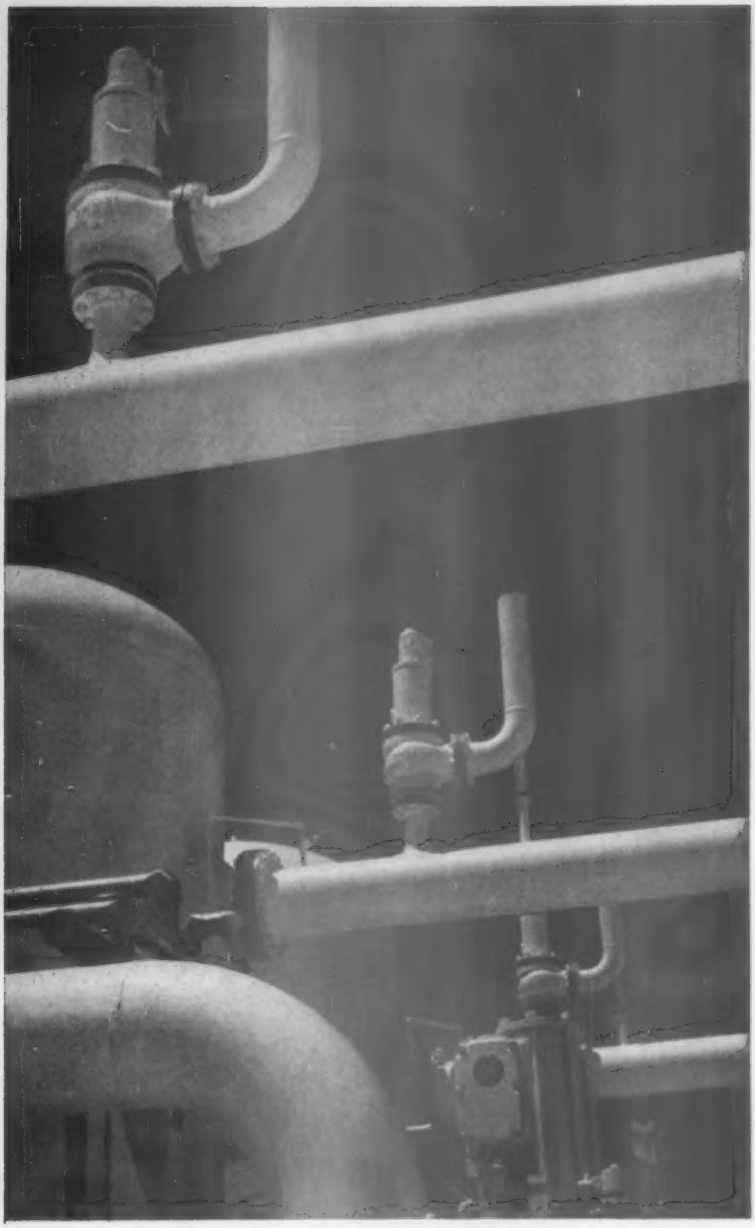
Learning to walk . . . the second time. The facilities of Liberty's two rehabilitation centers are made available to badly injured employees of policyholders. Through therapy and prosthetics know-how, patients help themselves recover, get back on the job.

(Right)

Making dangerous jobs safe. Liberty Mutual's safety engineers can help you cut down on accidents by instructing your man in proper operating procedures. Our safety-engineering services have helped hundreds of oil-well drillers save money through reduced compensation costs.

(Left)

New look at injuries—new savings. In 64 areas of the country, Liberty Mutual retains leading specialists to check the diagnoses of serious cases and assist treating physicians. Result to policyholders: improved medical results and lower compensation costs.



Crosby Safety-Relief Valves on inlet scrubbers to gas booster station — El Paso Natural Gas Co., New Chaco Station, San Juan Co., N. M.

Where there's no compromise with safety...
you need the absolute reliability of
Crosby Safety-Relief Valves

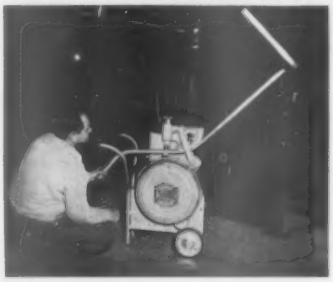
CROSBY VALVE AND GAGE CO.
Wrentham, Massachusetts
Offices in Boston, New York, Chicago, Los Angeles, Dallas, London, Paris.

Crosby
KEEPS PRESSURE ON THE SAFE SIDE

- **Safety Valves** for power boiler code requirements
- **Safety-Relief Valves** for unfired pressure vessel code requirements
- **Pressure Indicating and Recording Gages**
- **Pressure Testing Instruments**

SHOWCASE . . .

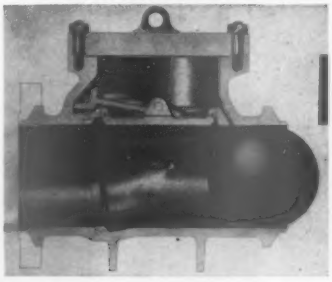
New Equipment



Conduit bender moves easily to job

. . . as it is mounted on wheels. Called the Condumatic, the recently announced tool can be used to bend pipe and tubing as well as conduit. It will produce precisely duplicated elbows and offsets in all classes of materials at the rate of three bends a minute, the maker reports. The bends may be made on various radii.

The tool promises to overcome the hazards and imperfections of hand bending and the nuisance of set-up. The Model 105 bender is rated at 110 volts a.c., 25-60 cycles. It weighs about 150 lb. and sells for about $595 f.o.b. factory. SOURCE: **Chamor Mfg. Corp., Dept. OGJ, 43-63 Eleventh Street, Long Island City, N. Y.**



Check valve lets pigs pass through

. . . as well as short scrapers and ball type of product separators. The conduit type of check valve, recently developed, is designed so the bonnet cavity of the valve body is completely sealed when the valve is in the open position, preventing turbulence and reducing pressure drop.

The valve comes in sizes of 2 through 36 in. in ASA 150 through 2,500-lb. series. If desired, the valve can be obtained with the clapper shaft extended through the valve body for use of a counterweight or clapper operator. SOURCE: **Tom Wheatley Co., Dept. OGJ, P. O. Box 2094, Houston.**

HERE IS THE ANSWER TO YOUR "HOT COFFEE PROBLEMS" ON LOCATION

The cost is low $12.00 Postpaid — **Quantity discounts**

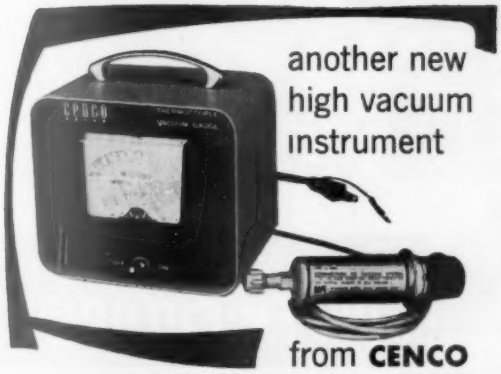
The First Continuous Operation Electric Percolator For Use On DC or AC Powered Drilling Rigs Makes 10 Cups—Keeps Coffee Hot.

RIG-POT AC or DC RIG POWER

Rig-poT Products Company

1622 West First — Elk City, Oklahoma

another new high vacuum instrument



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Continuously measures total pressure of gases in the range 1-1000 microns Hg. Direct reading, self-regulating, sturdily built for industrial use. 115 volt, 60 cycle AC operation. Write for details.

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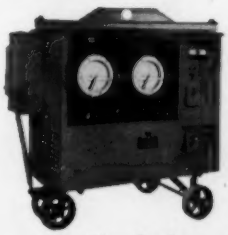
One of a Series on Applications of Electric Arc's Smith-Dolan Units—Today's Most Versatile Heat-Treating Tools.

STOP WELD FAILURE *with the* SMITH-DOLAN SYSTEM *of Low-Frequency Induction Heating*

Here is the versatile heat-treating tool you need for producing sound welds easily and economically in carbo-alloy and other types of steel pipe . . . here is precision control of heating cycle when pre-heating and stress relieving — uniform, through-and-through heating of solid sections up to two feet thick and more — pushbutton operation — complete portability for on-the-job heat treating anywhere.

Many Money-Saving Applications — The Smith-Dolan System simplifies and upgrades work quality in numerous applications ranging from welding to forming and annealing. Units are available for 60 cycle heating in capacities ranging from 10 to 150 KVA . . . for 400 cycle heating . . . resistance heating. Pre-engineered with complete instrumentation, accessories.

"On Trial" Installations on Rental Basis — Prove the many Smith-Dolan advantages in your own plant without capital investment. Write, wire or phone.



Electronic recording gives permanent charts of heat run on this standard Smith-Dolan model. Coils permit work at 50 feet or more from unit. Eye hooks provide for easy handling by crane. Products ranging from a fraction of an inch to 10 feet in diameter can be heat treated on the job.

New Brochure — Send today for your copy of "Smith-Dolan System of Low-Frequency Induction Heating."

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BURGESS-MANNING

SNUBBER NEWS

Dedicated to the Elimination of Pulsation and Intake and Exhaust Noise

Flue Gas Silencer at the Premier Oil and Refining Company, Fort Worth, Texas

In recent years most of the veil has been removed from the mystery surrounding the theory and practical approaches to industrial noise control. Even so, there exists today an increasing challenge in this field.

High-level industrial noises may have a deafening or harmful effect on employees or residents in the immediate area where the intensity is great—still, only the morale and efficiency of the workman may be affected. Of major concern are noises from high speed blowers, compressors, vent gas systems, gas, diesel, and steam engine exhausts and intakes, especially when located in a populated area.

During the 25 years that the Burgess-Manning Company has been specializing in the elimination of industrial noises, their engineers have pioneered many new principles of noise suppression. One such accomplishment is the development of a dynamically reacting silencer which subdues the abounding noise energy created in venting high temperature erosive flue gases from the regenerator of a cat-cracker.

Today there are scores of Burgess-Manning Flue Gas Silencers installed in refineries over the world. They have built a perfect record of performance and durability.

One such location is the Premier Oil and Refining Company of Fort Worth, Texas, where a Burgess-Manning Flue Gas Silencer has been in continuous service for more than four years.

Company officials there justly concerned with the desirability of good employee and community relations recognized this problem from the beginning of operation. Burgess-Manning engineers were called in to analyze the extent of their noise problem. A special high temperature, erosive-resistant silencer was recommended and subsequently installed near the top of the regenerator stack on the flue gas vent.

The noise level from the unsilenced flue gas averaged 94 db in the adjacent area. After installation of the silencer, this level was reduced to approximately 78 db (a 95 per cent reduction in noise energy), just about the level of the normal refinery background noise.

Operational Features Burgess-Manning Flue Gas Silencers

1. Reduces flue gas vent noises to approximately background levels.
2. Erosion Resistant.
3. Self supporting, ruggedly designed for continuous trouble-free service.

TYPICAL BURGESS-MANNING SNUBBER

Burgess-Manning Snubber being installed on the flue gas vent of the catalyst regenerator at the Premier Oil and Refining Co. Plant, Fort Worth, Texas.

SEND US a brief outline of your pulsation or exhaust noise problems and we will gladly send you pertinent literature.

Sound Engineering

BURGESS-MANNING COMPANY

Industrial Silencer Division

9217 Sovereign Row, Dallas, Texas

Libertyville, Illinois

KUNKLE GAUGES

FOR PROCESS & POWER INSTRUMENTATION

KUNKLE GAUGES

Complete, broad range line makes gauge application-specification easy with assured results backed by 50 years of gauge manufacturing experience.

Ranges from 15 p.s.i., or 30" of vacuum, to 20,000 p.s.i.

Bourdon tubes of bronze, drawn or bored s/s, and other alloys

YOUR COPY SHOWING NEW GAUGES AND SPEC. DATA NOW AVAILABLE WRITE:

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KUNKLE VALVE CO. · FT. WAYNE, IND.

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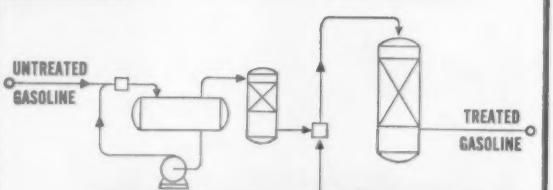

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Tennessee's Copper Chloride was developed to effect efficient Mercaptans removal.

Place your confidence in a basic producer of Copper Chemicals.

CUPRIC CHLORIDE DI-HYDRATE

Other products of interest—
Ferric Sulfate—Copper Sulfate,
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For samples make request on your company letterhead.

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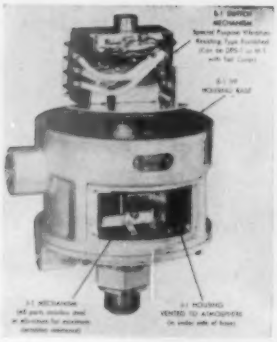
617-629 Grant Building, Atlanta, Ga.



Switch gives electric or pneumatic

. . . action for the first stage on rising or falling levels, regardless of the positioning of the components. The development combines a two-level-stage switching action to provide an electrical switch mechanism in a vaporproof and explosionproof switch housing mounted over a pneumatic-switch mechanism that is splashproof in its construction. Permitting use of either air or gas as an operating pressure medium, the Model J-1 S-1 tandem head is available with a variety of actuators. SOURCE: **Magnetrol, Inc., Dept. OGJ, 2110 South Marshall Boulevard, Chicago 23.**

●

Bench speeds pressure test of valves

. . . of all types used in refineries and petrochemical plants. This new valve test bench has two test plates. One is for ½ through 2-in. screwed valves and 8 through 10-in. flanged valves. The other plate is for 2½ through 6-in. flanged valves. Separate controls and gages are available so two different valves can be tested at the same time. Adapters permit quick change over from one size and type of valve to another.

Valves can be tested with gas or liquid at pressures from 1 to 1,000 psi. on the maker's standard bench. Other benches are available for higher pressures. One advantage of the unit is that it is portable. Thus it can be used in the field on plant turnarounds or new construction work. SOURCE: **Piping Engineering Co., Dept. OGJ, 3521 Sand Springs Road, Tulsa.**

At Last A COMPLETE LINE OF EXPLOSION-PROOF DISCONNECT SWITCHES FROM KILLARK

- Fusable and Non-fusable
- Lightweight, non-rusting, non-corroding aluminum construction.
- Full range of hub arrangements and conduit sizes.
- Convenient mounting lugs.

Killark ELECTRIC MANUFACTURING COMPANY

WRITE for illustrated bulletin

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Master's facilities and equipment, plus experience and know-how, assure proven ability to fabricate pressure vessels to rigid engineering specifications. Write — wire — phone MASTER FIRST for the finest in steel fabrication.

another MASTERPIECE *fitted for the* JOB

Master also produces API 5LX HI-TEST Expanded Line Pipe 20" through 30" or larger

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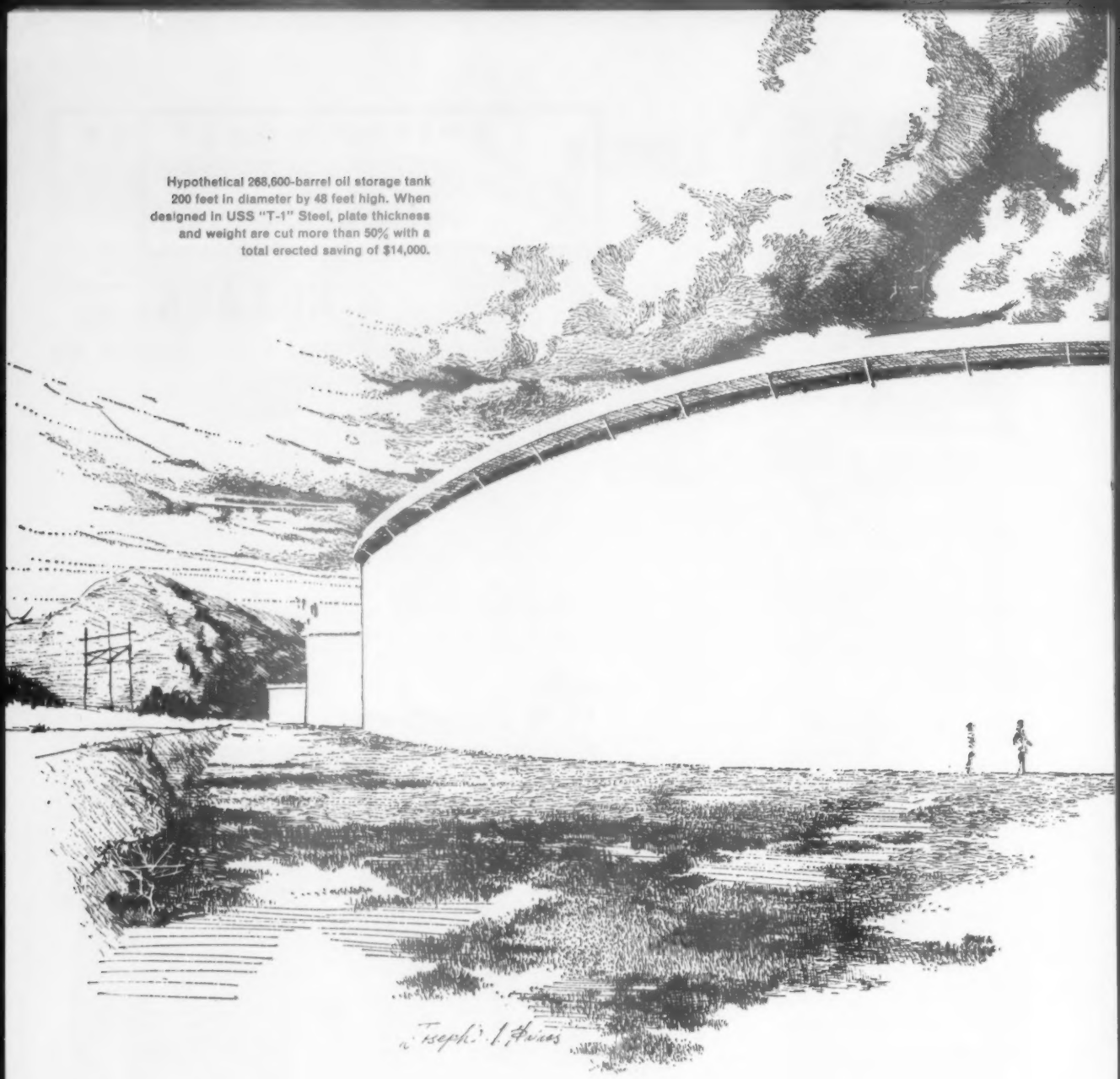


Hypothetical 268,600-barrel oil storage tank 200 feet in diameter by 48 feet high. When designed in USS "T-1" Steel, plate thickness and weight are cut more than 50% with a total erected saving of $14,000.

Design Advantages of USS "T-1" Steel

The following thickness and cost figures result from comparing *two* designs for the tank—one using ASTM A283 structural carbon steel following API Standards, the other using USS "T-1" Steel at a higher design stress than permitted by API. Note, that although a higher unit stress is used with "T-1" Steel, an even higher safety factor on yield strength is obtained.

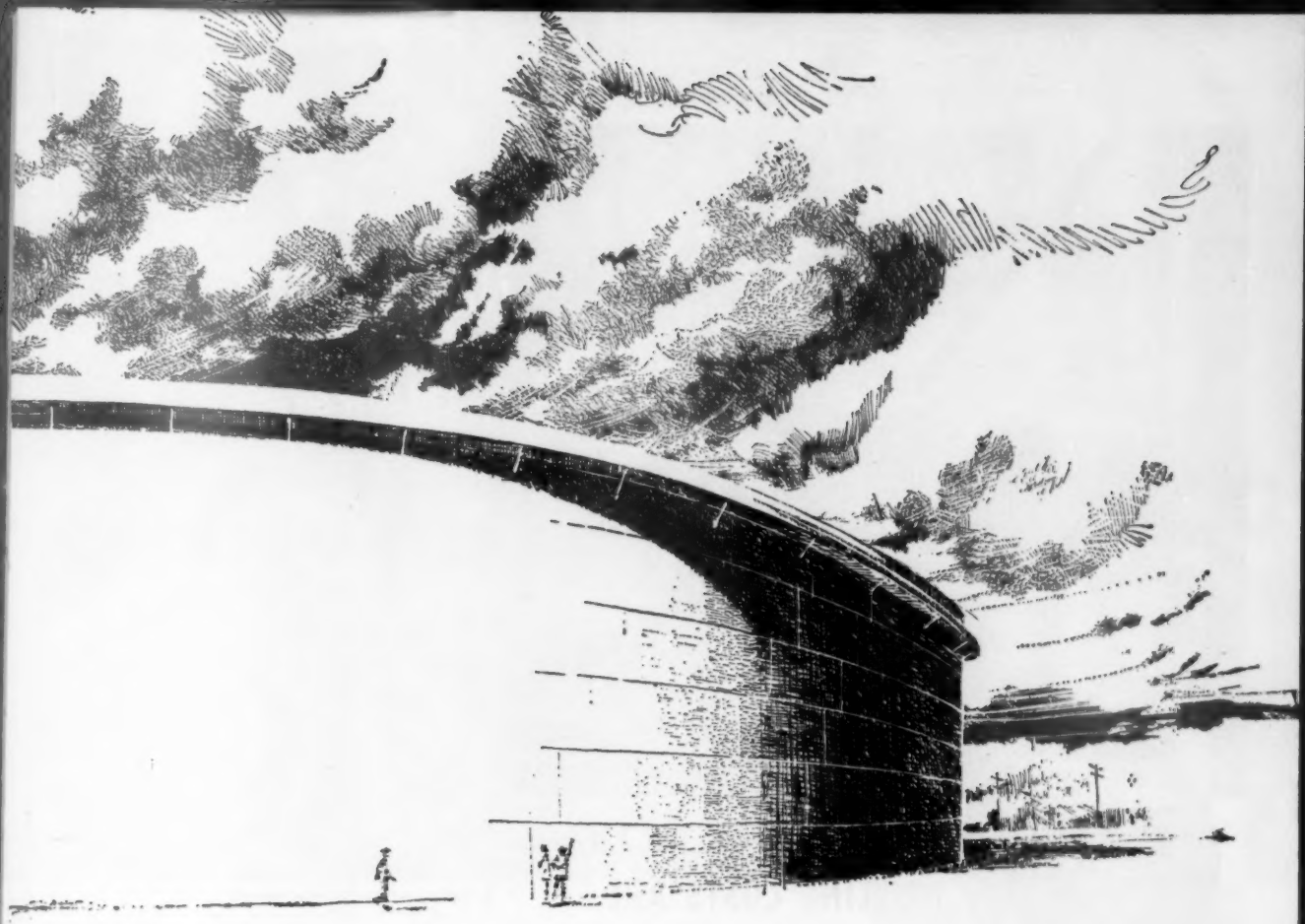
	USS "T-1" STEEL	ASTM A283 Carbon Steel
Yield Strength	100,000 psi	30,000 psi
Design Stress	50,000 psi	21,000 psi
Joint Efficiency	0.85	0.85
Working Stress	42,500 psi	17,850
Factor of Safety on Yield Strength	2.44	1.68

PLATE THICKNESSES COMPARED

	USS "T-1" STEEL	ASTM A283 Carbon Steel
Course No. 1	0.59"	1.37"
Course No. 2	0.49"	1.14"
Course No. 3	0.39"	0.91"
Course No. 4	0.3125"	0.67"
Course No. 5	0.3125"	0.44"
Course No. 6	0.3125" (A283 Steel)	0.3125"

How USS "T-1" Steel can reduce costs (compared with A283 Steel)

Material cost:	$4,400 more
but	
Fabricating cost:	$6,160 *less*
Freight cost:	$4,930 *less*
Erection cost:	$7,310 *less*
Overall savings with "T-1" Steel	$14,000



$14,000 can be saved by building this oil storage tank with USS "T-1" Steel

Here is a design for an oil storage tank that hasn't been built yet. It is 200 feet in diameter by 48 feet high. Capacity: 268,600 barrels.

The tank was designed by a well-known firm in this field—Pittsburgh-Des Moines Steel Co. The costs were estimated for both structural carbon steel to API standards and for building the tank with USS "T-1" Constructional Alloy Steel. In both cases, the bottom plates, roof plates and framing are all ASTM A283 carbon steel. The comparisons apply only to the shells.

USS "T-1" Steel construction costs less. As you can see from the chart, the total cost of the shell construction with USS "T-1" Steel is $14,000 less than with carbon steel, although the cost of the steel itself is $4,400 more. The big savings come from lower costs of fabrication, freight and erection. The reason for this is that USS "T-1" Steel's great strength (100,000 psi minimum yield strength) permits the plate thickness to be reduced more that 50% in most cases. The total steel weight is less, the thinner plates cost less to weld and ship, and fabrication costs are estimated to be lower.

Lower maintenance, too! USS "T-1" Steel has four times the resistance of carbon structural steel to atmospheric corrosion. Research has shown that paint life is extended on steels that have increased resistance to atmospheric corrosion; consequently, longer intervals between paintings is an added advantage of using USS "T-1" Steel.

Retains Toughness down to —50° F. USS "T-1" Steel's exceptional strength and toughness, even at very low temperatures, make it the ideal material not only for tanks, but for pressure vessels, equipment hauling trailers, offshore rigs and other equipment that must be built stronger but lighter. Write for a copy of our booklet, USS "T-1" Steel. United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

USS and "T-1" are registered trademarks

United States Steel Corporation—Pittsburgh
Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

**OFF SHORE OR INLAND--
DRILLING COSTS ARE
LESS with the**

DEMCO DESANDER

From the Pacific coast to the mid-continent, from the Arctic to Argentina, Demco Desanders have proved their ability to lower drilling costs. Operators everywhere have found these versatile units to be the most efficient, most economical means of controlling sand and solids in drilling mud.

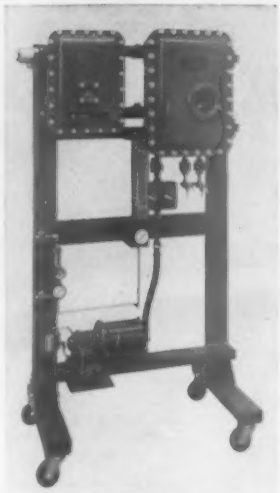
The Demco Desander removes virtually all these solids—in particle sizes from 320 mesh and larger. This reduces mud weight, improves other of the mud properties. Circulation losses are minimized and penetration is faster. Mud and Chemical losses from jetting of pits are held to a minimum. This removal of abrasives also reduces maintenance costs. Bits, pump fluid end parts, tool joints, wash pipes, mud lines and valves *all last longer.*

Major wear surfaces in Demco Desanders are fully protected. Cone liners and under-flow orifices are of ceramic materials which provide maximum resistance to abrasives. Sizes range from the Demco Model 10 single cone unit, with a capacity of 200 GPM, to multiple cone units with capacities up to 1200 GPM. All models are available with or without power and centrifugal pump.

For details or a quotation on a Demco Desander *tailored to your specific needs,* call or write your Demco representative or our Oklahoma City office—today.

DRILLING EQUIPMENT MANUFACTURING CO.

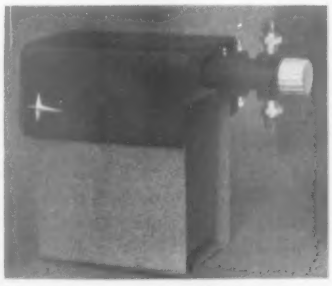
845 S.E. 29th St. • OKLAHOMA CITY, OKLA.



Distillate boiling-point recorder

. . . recently developed can be used to determine such boiling points as the 90% point. The Model 1238 instrument is a Shell Development Co. design. It uses a falling-film flush evaporator. Liquid temperature rather than vapor temperature is measured.

The instrument is designed so a constant sample flow (30 ml. a minute) is introduced onto a falling-film flash evaporator where about 97% or 29 ml. a minute is evaporated. The remaining residue (1 ml. a minute) drops off the tip of the evaporator where its temperature is measured by a thermocouple. This condition is maintained by controlling the heat to the evaporator by an electronic controller. The instrument is of explosionproof construction to meet the requirements of Class 1 Group D installations. Its operating range is between 200° and 600° F. SOURCE: **Hallikainen Instruments, Dept. OGJ, 1341 Seventh Street, Berkeley 10, Calif.**



Plunger-type feed pump

. . . recently developed for chemical treating of small low-pressure boilers has an adjustable stroke length that gives feed rates of 0.2 to 2 gal. an hour at a maximum discharge pressure of 300 psi. Design features of

FALK and STEELFLEX are Registered Trademarks

Cut disconnect-reconnect time by as much as 50%

The FALK Spacer Coupling is specially designed for quick installation or removal *without disturbing the driving or driven unit.* This feature can save you up to 50% in disconnect-reconnect time when critical equipment—a process pump, for example—needs repair or replacement.

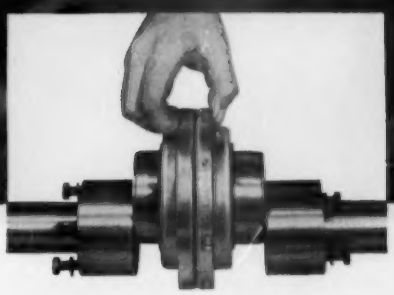
Here's another saving: with the FALK Spacer Coupling, you can quickly realign shafts *without the usual loss of operating temperature!*

And still another: you can remove or reinstall the FALK Spacer as a unit *without draining the lubricant.*

Because of its exclusive grid-groove Steelflex design, the FALK Spacer can accommodate residual misalignment—parallel, angular, or (most important) *both.* Also, it provides torsional resiliency that cushions shock and vibration. Thus it saves wear-and-tear on your connected equipment.

To prove these claims and enjoy these savings, install a FALK Spacer on one application—and see for yourself. Consult your FALK Representative or Authorized Distributor.

THE FALK CORPORATION, MILWAUKEE 1, WISCONSIN
MANUFACTURERS OF QUALITY GEAR DRIVES AND FLEXIBLE SHAFT COUPLINGS
Representatives and Distributors in many principal cities.

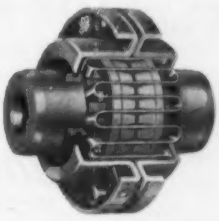


EASY AND QUICK TO INSTALL, DISCONNECT OR RECONNECT

First, mount shaft hubs to allow proper distance between hubs; then, align driving and driven units.

Second, compress Spacer to fit space between hubs and tighten cap screws to pull spacer hubs into the registered fit.

To disconnect, reverse the second step. No draining of lubricant necessary.



The heart of the FALK Spacer ...the basic Type F Steelflex
Write for Service Manual 4838

FALK
...a good name in industry

How to repack a big-tank mixer – the easy way

Just a few turns of the handles.

That's all it takes to lock up 80,000 barrels of product in the tank, while your maintenance man renews the packing or replaces the shaft seal on this LIGHTNIN Side Entering Mixer.

No need to find another place to put a tankful of liquid in a hurry. No big wrenches. No sweat or strain.

When the job's done, a few turns put the mixer shaft back in operating position again, ready for business—*automatically* realigned.

It's *easy*—and it saves money.

You'll see these handles in refineries and at pipeline terminals all over the country. They're visible proof of the long-term savings refinery men look for, and find, in this side-entering mixer.

Just as important are some of the economies that *don't* show on the outside.

The wide choice of stuffing boxes, for instance: there's one to meet every mixing or blending condition.

The rotary mechanical seal that takes the place of a stuffing box, if you wish. It eliminates all repacking, positively stops leakage—and is *easy to replace* when it finally wears out.

There are many other savings you'll want to know about before you decide on mixers for *your* big tanks. Your LIGHTNIN Mixer representative can tell you what they are. You'll find his name listed in Refinery Catalog. Why not get in touch with him now?

BLENDING PRODUCT or controlling BS&W in crude—you get the job done faster, at lower cost with LIGHTNIN Mixers. They're used in tanks as big as 200,000 barrels. Results are guaranteed.

Lightnin® Mixers

MIXCO fluid mixing specialists

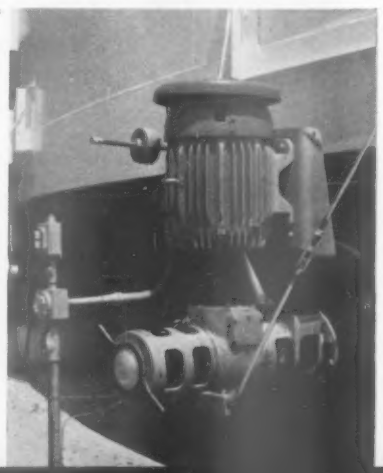
WHAT MIXING OPERATIONS ARE IMPORTANT TO YOU? You'll find a wealth of information on fluid mixing in these helpful bulletins describing LIGHTNIN Mixers:

- ☐ Top or bottom entering; turbine, paddle, and propeller types: 1 to 500 HP (B-102)
- ☐ Top entering; propeller types: ¼ to 3 HP (B-103)
- ☐ Side entering: 1 to 25 HP (B-104)
- ☐ Portable: ⅛ to 3 HP (B-108)
- ☐ Laboratory and small-batch production types (B-112)
- ☐ Condensed catalog showing all types (B-109)
- ☐ Quick-change rotary mechanical seals (B-111)
- ☐ Data sheet for figuring mixer requirements (B-107)

Check, clip and mail with your name, title, company address to:

MIXING EQUIPMENT Co., Inc., 174-j Mt. Read Blvd., Rochester 3, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Ave., Toronto 19, Ont.



SHOWCASE . . .

New Equipment

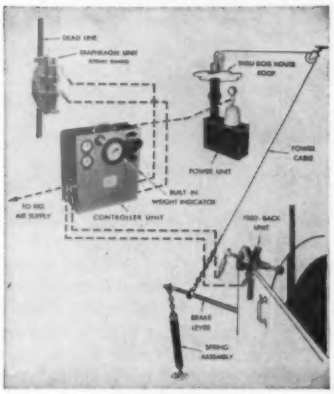
the Model 1107 Adjust-O-Feeder include check valves with a self-purging, straight-through design. The pump operates on 110 volts, 60 cycles a.c. power. SOURCE: **B-I-F Industries, Inc., Dept. OGJ, 345 Harris Avenue, Providence, R. I.**

●

Through-conduit pipeline valve

. . . made in England is now available that is designed to provide smooth, clear passage for pigs yet give a positive shutoff in rugged pipeline service. Made of cast carbon steel, the valve can be changed from manual to motor operation quite simply as a flange with dimensions equivalent to standard actuators or bevel gears has been incorporated in the larger sizes. The valve comes in sizes of 6 to 30 in. for cold working pressures up to 1,440 lb.—Figs. 18122, 38122, and 68122. Ends may be flanged or butt welded. SOURCE: **Triangle Valve Co., Ltd., Dept. OGJ, 315 Regent Street, London W1, England.**

●

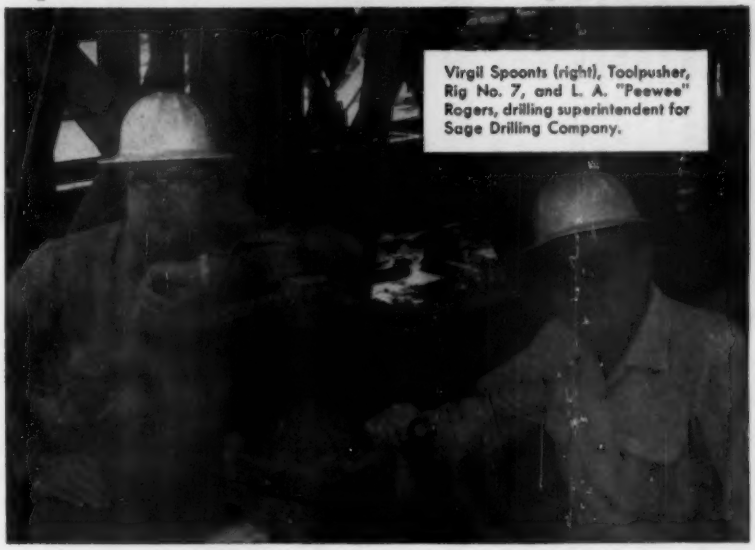


Pneumatic drilling-rig controller

. . . has been developed recently to provide close regulation of the weight setting on the drill bit. The maker claims the Automatic Driller will consistently maintain the set weight on the bit to within 500 lb.

The controller unit contains weight indicator that receives its signal from a pneumatic strain-gage type of diaphragm unit. The signal is unaffected

Tips on Mud Valves for Toolpushers...



Virgil Spoonts (right), Toolpusher, Rig No. 7, and L. A. "Peewee" Rogers, drilling superintendent for Sage Drilling Company.

Our Mudwonder Valves just *don't* sand up!

by Virgil Spoonts, Toolpusher, Rig #7
Sage Drilling Company, Blanding, Utah

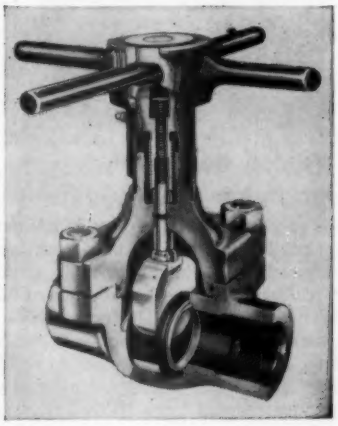
"I'VE used a lot of different mud valves in 10 years of toolpushing. Used to be, I'd have to baby them along . . . operate the standpipe valve every day or so to keep 'em flushed out. If I didn't, they'd sand up so bad I'd need a 36-inch wrench to close them.

"But not with Mudwonders. I've never had one jam up with sand in the seat. As soon as I bring the gate down close, the flow sluices all sand out of the way. I close 'em hand-tight and they hold. Never need a wrench.

"We rigged up new with Mudwonders on Number Seven. 17 two-inchers and 4 of the four-inch size. Since we started drilling, in August, 1957, we've had to repair only one of them. It was used on jet and hadn't been properly closed. But it's real easy to put in a new insert—or even a gate—without disturbing any connections.

"Lack of downtime is mighty important to us. We've had *no* lost time due to Mudwonders, except the ten minutes it took to repair the one I mentioned. Parts are no problem, either. We just keep a couple of seat inserts and an extra gate on hand for each size—how's *that* for inventory control?"

Mudwonder cut-away view shows the one-piece seat insert, with Buna-N molded integrally over steel wear rings; chromed gate with "T" slot connection; separated stainless stem and double thread construction.



Mudwonder valves are built in 2", 3" and 4" sizes; with screw or flange ends; for 2000 psi WP (4000 psi test) and 3000 psi WP (6000 psi test) service. See your favorite oil field supply store, or write Edward Valves, Inc., East Chicago, Indiana, subsidiary of Rockwell Manufacturing Company.

(Advertisement)

NO SHUT-DOWNS TO REPLACE EXPENSIVE RUBBER PARTS

PAYNE NON-SEPARATOR TYPE ACCUMULATORS in combination with PAYNE FAST-ACTING AUTOMATIC PUMPS have changed the whole picture of hydraulic power. They offer the most reliable and yet the most economical operation of blowout preventers and pressure operated valves on the market today.

Each 20 gallon accumulator contains a free-moving metal float which takes the place of unreliable rubber goods (bladders and diaphragms). Any volume of fluid is available with multiple units.

Payne Fast-Acting Automatic Pumps keep pressures at the proper level (2,000 psi) and instantly produce additional pressure for emergencies.

Ask anyone who has replaced old-style accumulator units with Payne Non-Separator Type Accumulators — you will understand why the reliability and increased economy of these advanced units have placed them on rigs throughout the drilling areas of the world.

Payne
MANUFACTURING COMPANY INC.
7317-7329 Canal Street
HOUSTON, TEXAS
Office WA 8-2626

by temperature changes and needs no adjustment for correction.

One particular feature of interest is that the unit can be installed on the rig while it is operating in about 2 hours. Rig air at a pressure of 60-psi. minimum is satisfactory to operate the controls. If air supply fails, the unit applies full brake. The unit can be purchased or rented. SOURCE: **Bear Mfg. Corp., Dept. OGJ, Box 606, Wichita Falls, Tex.**

●

Automatic mud-weighing instrument

. . . recently put on the market automatically indicates and records the weight of mud being discharged. It gives a continuous, uninterrupted safeguard against dangerously high or low weights. And it registers loss of circulation immediately.

The unit channels off a flow of mud directly from the flow line. Pumping the mud through a specially designed scale, it weighs a continuous flow sample.

Weight is permanently recorded on clock-driven chart and indicated continuously on a manometer. SOURCE: **Bell Mudwate Corp., Dept. OGJ, Box 849, Odessa, Tex.**

●

Welded-steel heat-exchanger tubing

. . . recently brought out is designed especially for petrochemical plant and refinery use. The Lectrosonic tubing has been subjected to 5 years of extensive field tests. The maker says it proved equal to or superior to seamless carbon-steel heat-exchanger tubing. Prices for the new tubing show savings ranging from 10 to 32% over grades of seamless tubing it has been designed to replace.

The tubing is produced to ASTM Specifications A-214 and A-334 Grade C and identical ASME specifications in sizes through 4½ in. o.d. and in all normally required standard wall thicknesses. SOURCE: **Babcock & Wilcox Co., Tubular Products Div., Dept. OGJ, 161 East Forty-second Street, New York City.**

●

Newest analog type of computer

. . . is designed with specialized capabilities for handling design and operating problems in the petroleum industry. It can perform optimization studies in exploration, production, transmission, refining, and operations research, the maker says.

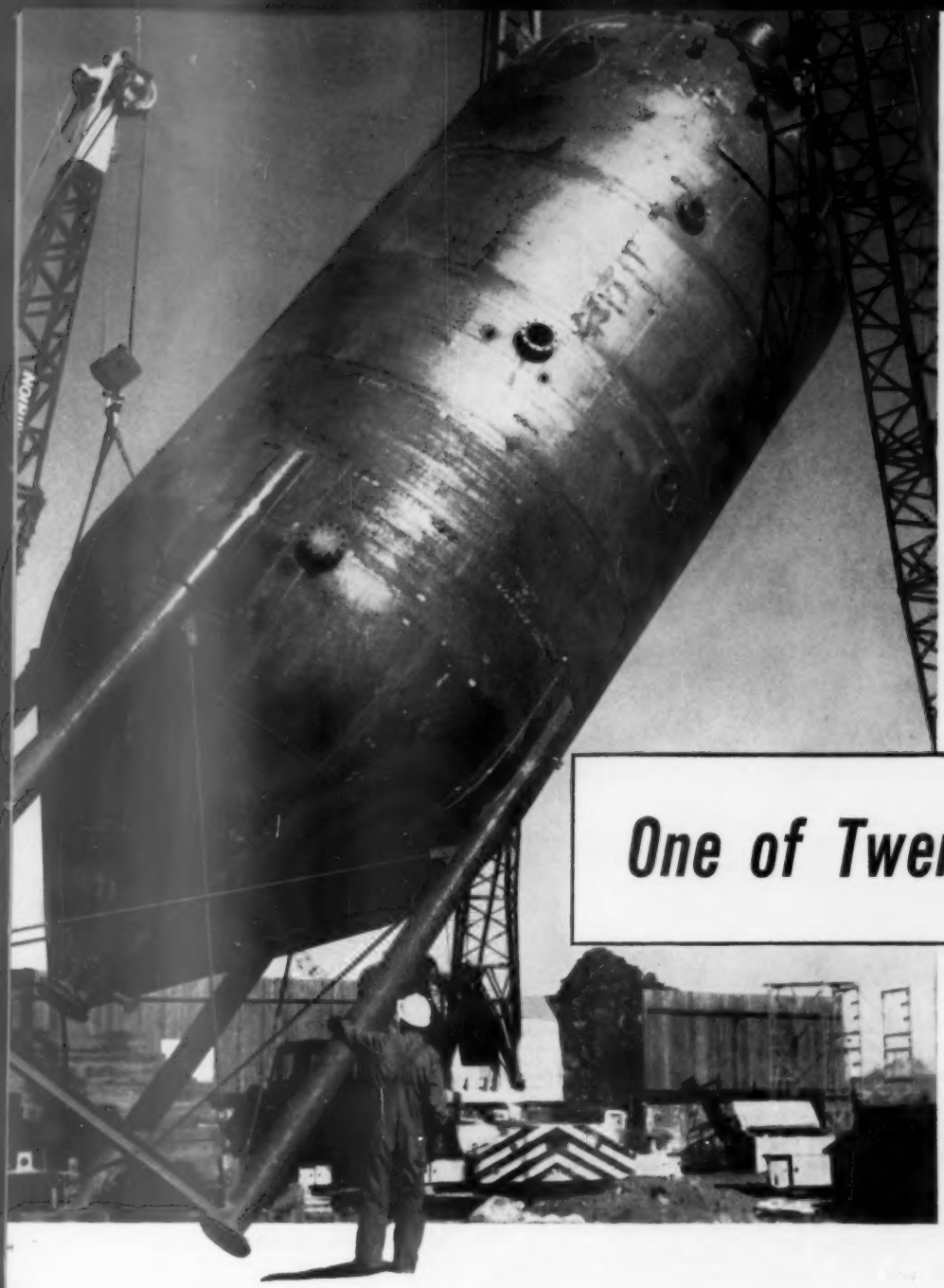
The MC-5900 Process Master computer features precision repetitive operation at 50 solutions a second. This will permit process engineers to vary equation coefficients and to observe the resultant effects continuously on a 17-in. oscilloscope. It also incorporates dynamic memory, generation of function of two variables, dynamic function generation, and high-frequency performance. SOURCE: **Computer Systems, Inc., Dept. OGJ, 611 Broadway, New York City.**

●

Pipe-identification system

. . . recently brought out comprises a coded tape integrated with pipe coating and wrapping for positive identification. Called Data-Tape, it incorporates a kraft paper tape stamped at 2-ft. intervals with coded intelligence. The code tells the pipe manufacturer, pipe wall thickness, chemistry, and type of manufacture, such as seamless or continuous weld.

The tape is spiral-wrapped around the pipe over the last protective coating or wrapper application. It's then covered with the kraft paper. The tape offers a way to eliminate the costly waste resulting from accumulations of unmarked pipe at storage facilities. SOURCE: **Hill-Hubbell & Co., Dept. OGJ, 3091 Mayfield Road, Cleveland 18.**



One of Twenty-four

This 40-ton, 60,000 gallon sedimentation tank was made by Dominion Bridge for Imperial Oil's new refinery expansion in Calgary. It is 55 ft. high, 18 ft. in diameter and one of the largest vessels to be shipped assembled in Canada. Altogether Dominion Bridge fabricated twenty-four vessels for this project in our Calgary and Edmonton plants.

Dominion Bridge plants are located in the principal centres across the country and are well equipped for the fabrication of steel plate to meet the exacting needs of every major industry.

PLATEWORK BY

DOMINION BRIDGE

Dominion Bridge Co. Ltd. Plants & Offices in Vancouver • Calgary • Edmonton • Winnipeg • Regina • Sault Ste. Marie • Toronto • Ottawa • Montreal • Amherst (Robb Engineering Wks. Ltd.)

Through Junior Achievement, thousands of teenagers like those above learn just what is involved in running a business. Here officers of the Jacoco Company, St. Louis, put the finishing touches on Jacoco products—decorative trays made from huge coconut leaves. (L. to R.) Jan Beiersdorf, vice president; Gene Burnett, president; Pat Reynolds, secretary; adviser Art Greene, Standard Oil Company; and Jean Good, treasurer.

Young "businessmen" learn an old lesson

Decorative tray by Jacoco

You might not think a Junior Achievement Company, like the Jacoco Company, and Standard Oil have much in common. Jacoco makes decorative trays—Standard, hundreds of oil products. Jacoco has 14 employees—Standard, 46,000.

But as Jacoco Company Junior Achievers learn, Standard and Jacoco have quite a bit in common when it comes to money matters. So does every other business.

A business takes in just so much money during the year. Out of this amount it must buy raw materials and supplies, pay its employees and pay taxes (some direct—some indirect). Then, if it is well managed, it will have something left over to provide for future growth and to pay owners a return on their investment.

Take Standard Oil and subsidiary companies, for example. Last year we worked from January 1 through December 12 (346 days, to be exact) just to cover our costs of doing business. Of every dollar we took in, 94.8¢ went to satisfy our obligations to our suppliers, our employees, to local, state and federal governments for taxes and to cover charges for wear and tear.

This left us 5.2¢—the result of only 19 days' operations—for profit. About half of this was used to strengthen our company by expanding facilities to improve the products and services you, our customers, receive. We are continually at work to make oil more useful to more people than ever before.

The balance went to our 152,000 owner-shareholders as dividends. This marked the 65th consecutive year that Standard has paid dividends. A total dividend value of $1.687 per share was paid in 1958.

So you see, no matter what its size a company must watch its pennies carefully if it is to continue to give its customers better value for their money. That is our constant aim at Standard.

WHAT MAKES A COMPANY A GOOD CITIZEN?

One measure of good citizenship is a company's frankness with customers, employees, stockholders, the public. We at Standard try always to keep our neighbors informed—to show how we work, where our money goes and how we contribute to the progress of the communities in which we live and work.

* * *

If you would like a copy of our complete 1958 Annual Report, just write to Standard Oil Company, 910 S. Michigan Avenue, Chicago 80, Illinois.

100th ANNIVERSARY OF THE OIL INDUSTRY
1959
70th ANNIVERSARY OF STANDARD OIL CO.

STANDARD OIL COMPANY
(INDIANA)

STANDARD
THE SIGN OF PROGRESS.
THROUGH RESEARCH

SHOWCASE . . .

New Literature

Tenamene petroleum inhibitors

. . . are featured in a new publication on gasoline additives now available upon request. Tenamene inhibitors, which include three different gasoline antioxidants and two metal deactivator formulations, are described as to chemical structure, properties, and function.

Eight-page Bulletin 1-106 gives suggestions as to the proper selection of an inhibitor, along with storage stability data on various inhibited gasoline stocks. **Contact Manufacturer: Eastman Chemical Products, Inc., Kingsport, Tenn., for Bulletin 1-106.**

Machinery brochures are available

. . . on traveling blocks, rotary tables, rig drives, and various models of draw works. Each publication contains a complete description of the product, including pictures and diagrams showing design features of parts and assemblies. Specifications, dimensional layouts, and power flow diagrams are included. **Contact Manufacturer: Mid-Continent Supply Co., P.O. Box 189, Fort Worth, for machinery brochures.**

Rotary gun-drilling catalog

. . . is a two color, eight-page publication, complete with 13 illustrations. It presents general specifications and descriptions including capacities, engines, air compressors, pumps, derricks, leveling jacks, and floodlights. Catalog KS-635 includes information on inset rock bits, portable mud pits, tool substitutes, stabilizers, and drill pipe. **Contact Manufacturer: Stardrill-Keystone Co., 1210 Kenton Street, Springfield, Ohio, for Catalog KS-635.**

Heat-transfer cements

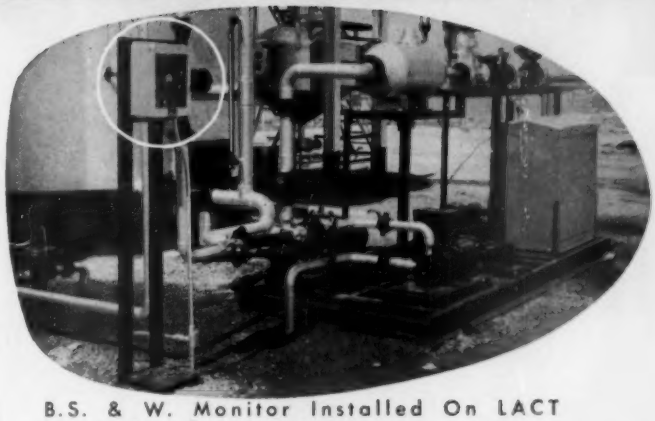
. . . publication lists properties and uses of Thermon, an inorganic cement in paste form for application over either conventional steam-traced or electrical-resistance systems. According to Engineering Data Book 502, Thermon, when cured to a cement-like hardness, bonds itself to coils and equipment to form an unbroken thermal connection.

Using the entire surface of the tracer tubing or electric heating cable, the cement conducts heat to the surface to be heated or away from the surface to be cooled.

The 48-page literature is broken down into four major sections: gen-

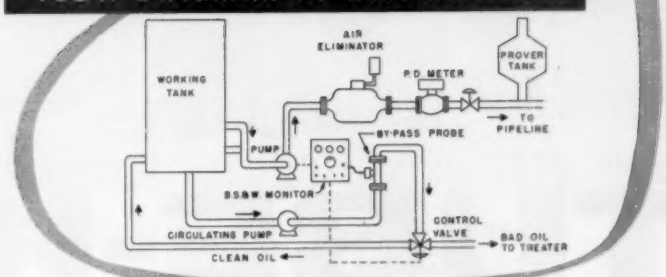
THE MOST IMPORTANT "A" IN LACT

B.S. & W. MONITOR



B.S. & W. Monitor Installed On LACT Pipeline Unit In Osage County, Oklahoma

FLOW DIAGRAM OF INSTALLATION



With the probe installed in-line or in a by-pass, the B.S. & W. Monitor provides continuous inspection and control of b.s. & w. content in crude being delivered to the pipeline. As long as contamination does not exceed setting of Monitor Limit Dial, crude will continue to line. If b.s. & w. content exceeds specifications, Monitor will re-route crude to treater or storage. When crude returns to merchantable condition, Monitor puts it back on line. All this is done AUTOMATICALLY. The B.S. & W. MONITOR MANUFACTURED BY INSTRUMENTS, INC., is the only instrument meeting the specifications for b.s. & w. control as published in the API Bulletin on Automatic Custody Transfer.

SPECIFICATIONS:

Range—From standard 0-3% b.s. & w. to 0-25%
Sensitivity—.05 water contamination
Accuracy—0.1 of 1% water contamination
Power—110 vac, 60 cps
Time Delay—10, 20, 30, 60, 120 or 180 seconds
Probes—2", 3", and 4" flanged, threaded or grooved

INSTRUMENTS INCORPORATED
TULSA

INSTRUMENTS, INC.

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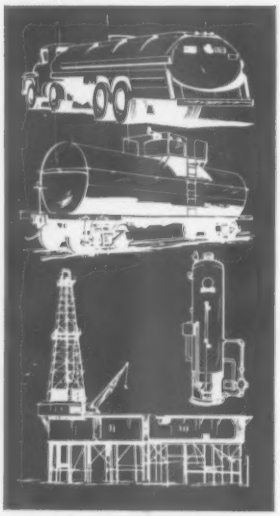
PIONEERS IN LEVEL MEASUREMENT AND CONTROL INSTRUMENTATION

TUBE-KOTE®

Coating for Industrial Corrosion Problems

Tube-Kote research has produced many new coatings . . . each with special properties needed to solve unique corrosion problems for the following industries:

Chemical	Food Processing
Petro Chemical	Oil Field
Refining	Plastic
Beverage	Textile
Electronic	Transportation



If you have a specialized coating problem, call on the experience and ability of Tube-Kote Industrial Sales Division to provide a coating for your particular needs.

TUBE-KOTE

Service Mark Reg. U. S. Pat. Off.

P. O. Box 20037 • Houston 25, Texas
Branch Plant • Harvey, La.

TUBE-KOTE RESEARCH AND SUPERIOR METHODS BRING YOU MORE DURABLE COATINGS AND FASTER SERVICE . . . AT LOWER COST!

eral information, engineering data and calculations, estimating and installation data, and engineering data. SOURCE: **Thermon Mfg. Co., Dept. OGJ, 1017 Rosine Street, Houston.**

Automatic-control systems

. . . for gas-engine compressors are described in Bulletin 3276, which may be obtained upon request. The four-page literature details Ingersoll-Rand's Tendamatic control, gives applications, outlines a typical engine-compressor installation, and lists functions that can be performed by the system.

These include automatically timed steps for starting procedure, speed and capacity regulation, constant guarding of the unit against malfunction, and normal shutdown and sequence control.

The bulletin describes an engine compressor, controlled by the Tendamatic system in an unmanned gas-distribution station. It shows how operating conditions are telemetered to an office by microwave. SOURCE: **Ingersoll-Rand Co., Dept. OGJ, 11 Broadway, New York City 4.**

Fuel-oil additive manual

. . . details problems in the storage and use of distillate and residual fuels. The publication, which is available gratis upon request, presents problems such as sulfur and vanadium corrosion, sludging of fuel oils, and rusting of fuel-oil tanks in connection with three fuel-oil additives available for overcoming these difficulties. SOURCE: **L. Sonneborn Sons, Inc., Dept. OGJ, 300 Park Avenue South, New York City 10.**

Electric bottom-hole heater

. . . is detailed in an obtainable four-page literature piece. The bulletin reports that the new instrument is capable of increasing production, can be operated by your own field personnel, and will not coke oil. Photos, features, specifications, and performance records are given. SOURCE: **Hydrolec, Inc., Dept. OGJ, P. O. Box 11364, Fort Worth.**

Continuous Automatic Lube Blending

. . . is the title of a new 16-page bulletin which describes a new system—Proportioneers—for the blending of lube oils. The system results in a control which permits complete production records to be kept. Bulletin 2055.21-1 cites economic advantages of the method, and includes photopraghs of installations and component parts, and numerous flow diagrams showing both solid and flexible con-

National Torque Converters are "Globe-Trotters"

If National Torque Converters carried travel stickers—as the luggage of tourists does—you'd see at a glance what globe-trotters these products really are.

We know of rigs equipped with Torque Converters that are drilling or have recently drilled in the Argentine; in Canada; in Venezuela; in Trinidad; in France; in North Africa; in Iran. They are helping to transmit power smoothly, not only on domestic prime movers, but on MGO and Paxman Engines, which further expands their global field of operation.

This widespread use in remote corners of the earth points up a very important feature of National Torque Converters. Overseas drilling locations are a long, long way from parts depots and repair shops, and breakdowns must be avoided at all costs. The reliability that is built into every National Torque Converter is a major advantage. The Converters not only help a rig to make more hole faster with less strain on operator and equipment, and do more useful work between overhauls . . . they also promise and deliver dependability that has run up to three-quarter of a million feet of hole with no stoppages or shutdowns.

A Torque Converter Bulletin, No. 496, has recently been issued. If you would like a copy, please write:

THE NATIONAL SUPPLY COMPANY

Subsidiary of Armco Steel Corporation

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HENRY H. PARIS DISTRIBUTOR, Inc.

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ALTEN FOUNDRY & MACHINE WORKS
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DRESSER MANUFACTURING DIV.
Bradford, Pa.
Seamless Welding Fittings, Couplings and Sleeves.

OIL STATES EQUIPMENT COMPANY
Houston, Texas
OSECO Silvertop Fusible Plugs with renewable inserts for all types OIL COUNTRY BOILERS.

THE FAIRBANKS COMPANY
Binghamton, N. Y.
Bronze and Iron Valves.

STEEL FORGINGS, INC.
Shreveport, La.
Weld Saddles.

THE GORMAN RUPP COMPANY
Mansfield, Ohio
Centrifugal Pumps.

VOLCANO BURNER COMPANY
Houston, Texas
Volcano Superior and Gulf States All Steel Gas Burners for OIL COUNTRY BOILERS.

HARRISBURG STEEL COMPANY
Harrisburg, Pennsylvania
Forged Steel Flanges and Seamless Casing Couplings.

WESTERN SAFETY BARREL STAND
Houston, Texas
Stand lifts, holds, tilts 55 gal. barrels Prevents spillage—easily loaded.

LOS ANGELES BOILER WORKS, INC.
Los Angeles, Calif.
Welding Caps—Dished & Flanged Heads.

WHEELING MACHINE PRODUCTS CO.
Wheeling, West Virginia
XL Steel Pipe Couplings for OIL COUNTRY TUBULAR PRODUCTS.

nections, each with centrifugal pump and positive-displacement pump.

The literature contains a schematic plan of the lube-oil blending system, a dimension drawing of a continuous mixer, copies of a batch-record printed ticket, and a log sheet. SOURCE: **Proportioneers Div., B-I-F Industries, Inc., Dept. OGJ, 345 Harris Avenue, Providence 1.**

Phamphlets describe seven products

. . . including Centerfit wire rope; cable-laid slings; PlastiKore and SpringKore wire rope; JalKlamp and JalLoc slings, and oil-field manila rope. Each of the four-page pamphlets describes various applications, specifications, and sizes. A guide on how to order wire rope is also presented. SOURCE: **Jones & Laughlin Steel Corp., Dept. OGJ, Three Gateway Center, Pittsburgh 30.**

JIC standard symbols and diagrams

. . . for industrial equipment and valves are contained in a new reference chart, free upon request. The chart, which gives both hydraulic and pneumatic symbols, measures 8½ by 11 in., and is punched for hanging. The yellow, black, and white chart is designed for ready reference to standard symbols and cross-referenced for valves. SOURCE: **Republic Mfg. Co., Dept. OGJ, 15655 Brookpark Road, Cleveland 35.**

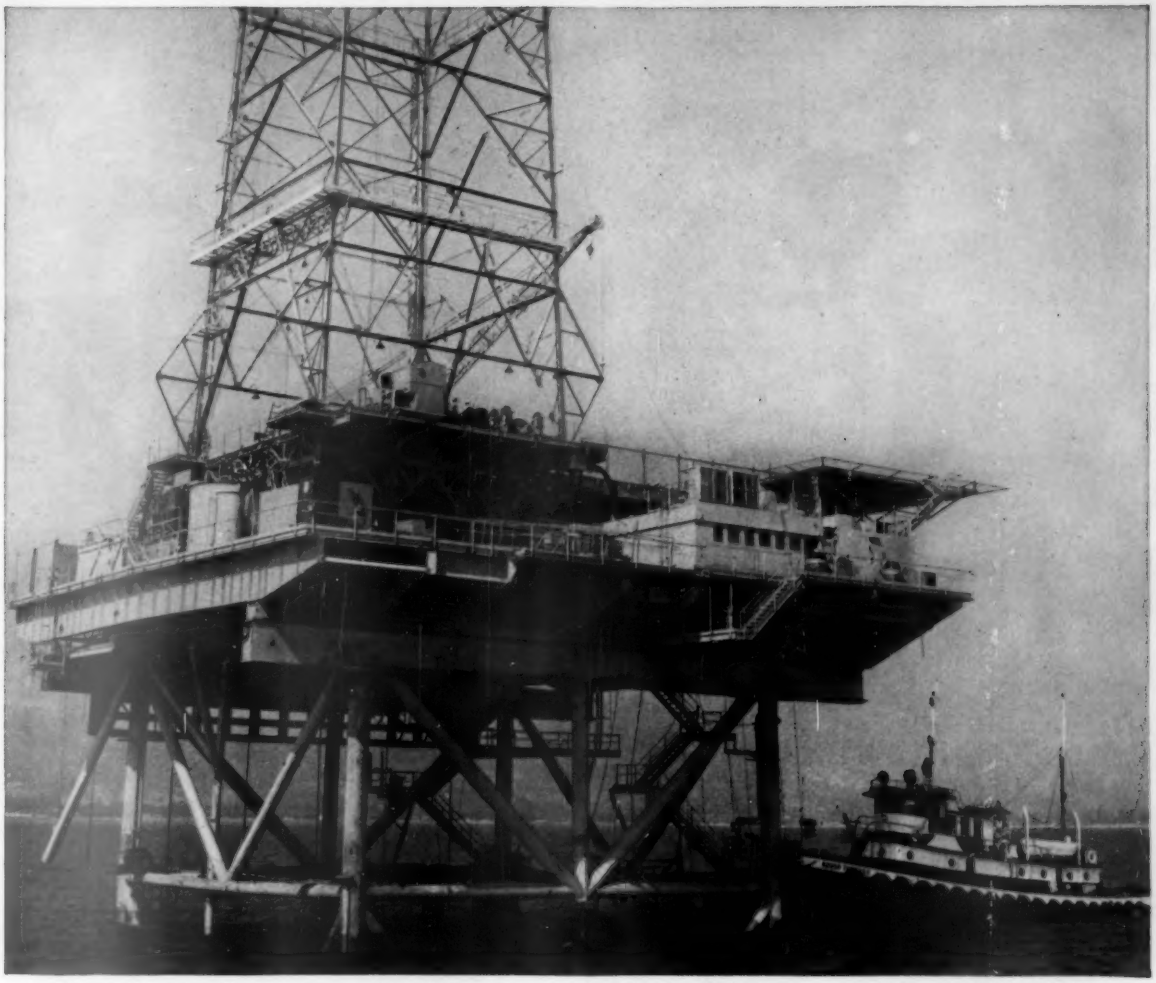
48-ft., two-piece rod pump

. . . designed for long-stroke pumping can be broken apart and carried on the side of an automobile, as described in an available bulletin. Included in the four-page literature is a section on a rod pump which has a double-thick, honed-finished barrel tube that is induction heat-treated to produce a hardened wearing surface on the inside, yet is ductile and shock-resistant on the outside. SOURCE: **Harbison-Fischer Mfg. Co., Dept. OGJ, P. O. Box 127, Fort Worth.**

Bulletins give cleaning tips

. . . such as details on caring for diesel engines to obtain high performance, economy, and engine life. Special tips are included on maintaining engines to reduce down-time and repair costs.

The four bulletins—entitled Defeating Dirt—deal with: (1) air cleaners; (2) tubing, hose, and clamps; (3) breathers, fillercaps, and dipstick; and (4) lube-oil and fuel filters. SOURCE: **Cummins Engine Co., Inc., Dept. OGJ, Columbus, Ind.**



Monel alloy sheathing protects against tidal zone corrosion of structure supporting first permanent drilling platform off California shore. Platform is jointly owned by Standard Oil Company of California and Humble Oil and Refining Company. It was fabricated by National Steel and Shipbuilding Corp., San Diego, California.

Supporting California's first permanent offshore platform...

sea legs defended from corrosion with Monel*

Key concept in this offshore drilling platform is *permanency.*

It's designed not only for drilling but also for year-after-year *production* of up to 25 wells.

Jointly owned by Standard Oil Company of California and Humble Oil and Refining Company, the platform is located two miles off Summerland in 100 feet of sea water. An unusual 140-foot derrick rigged for dual operation permits drilling two wells at a time.

Structure is built to last

In designing the platform, considerable attention was paid to the problem of preventing sea water corrosion of the supporting structure. For about 10 feet...in the critical splash and tidal zone where painting is impractical and cathodic protection is non-continuous . . . all vertical and cross members are sheathed with Monel nickel-copper alloy.

Experience on the Gulf Coast and with radar islands has shown that in this critical zone Monel alloy sheathing offers the best and least expensive corrosion protection.

When made of Monel alloy many items of equipment last longer

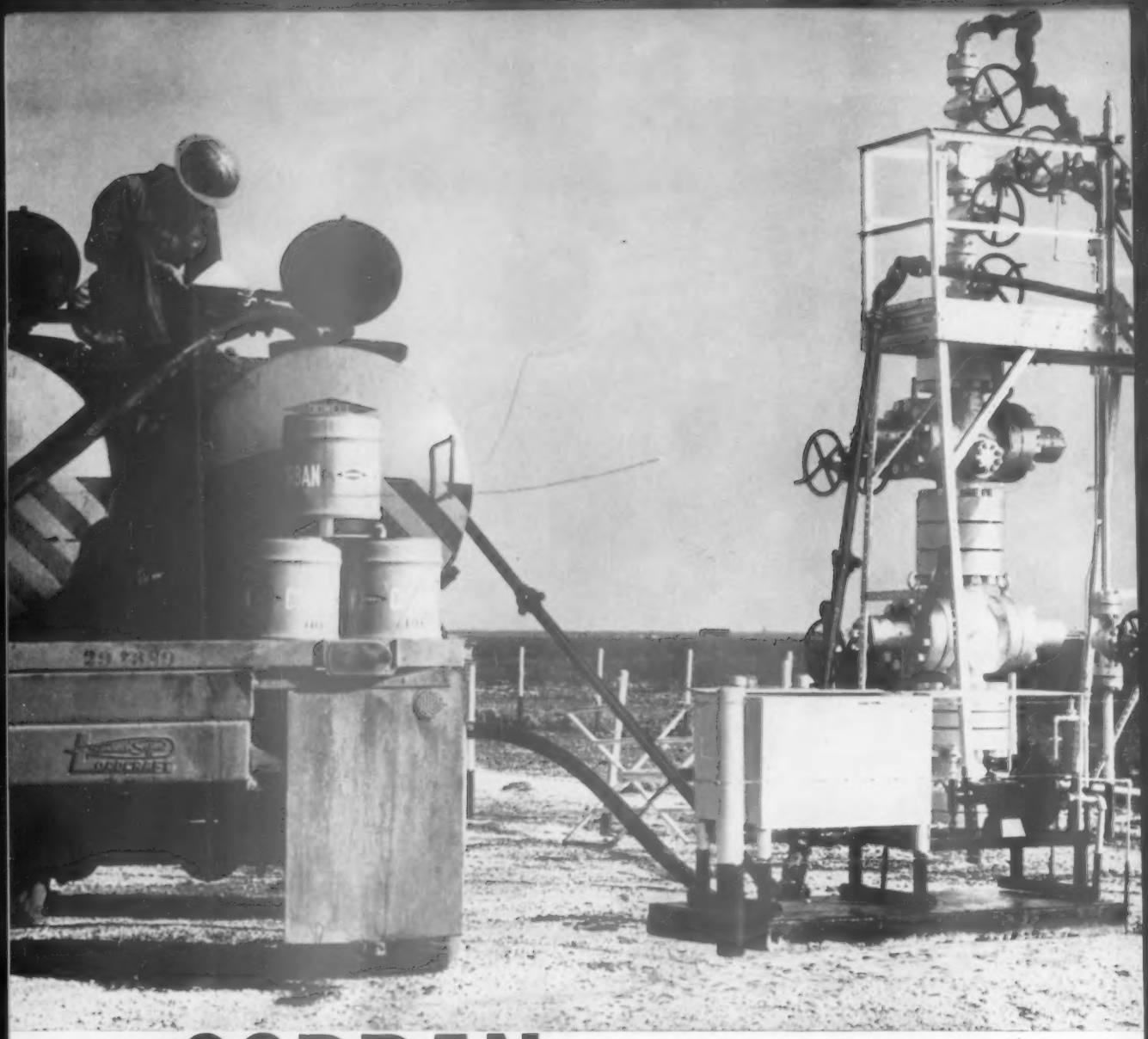
Monel nickel-copper alloy is ideal for equipment exposed to the corrosive conditions common in oil fields . . . salt water, acids, sour crudes. In instrument parts, screen cloths, polished rods, valves, pump parts, many other items, Monel alloy is widely used.

An Inco booklet "Metals to Make Petroleum Equipment Produce More", goes into details. We'll be glad to send you a copy.

*Inco trademark

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
67 Wall Street New York 5, N. Y.

MONEL®



CORBAN

new "squeeze" technique gives extended well protection

The new "squeeze" method of applying Corban®—Dowell's polar-type corrosion inhibitors — is setting new records for long-time corrosion protection in oil and gas wells.

The "squeeze" method involves pumping liquid Corban back into the producing formation. The Corban is then gradually produced back with your normal production over an extended period of time. As it is produced, Corban plates out in a protective film on the metal equipment contacted by the well fluids.

The "squeeze" with Corban has given long-term protection—six months and more—to many problem wells, particularly those with high pressure.

Ask your nearest Dowell station or office for case histories of wells squeezed with Corban, and for a recommendation engineered for your wells. Corban is now readily available from any of the 165 Dowell offices. Dowell serves the oil industry in the United States, Canada, Venezuela and Argentina. Dowell, Tulsa 1, Oklahoma.

Products for the oil industry DOWELL

DIVISION OF THE DOW CHEMICAL COMPANY

Northern Mud Co. shuffles

. . . sales and service personnel, following the relocation of the firm's general offices in Denver.

W. W. Fraser has been promoted to northern regional manager. Previously he was division manager in Williston, N. D. W. L. Smith, former Casper divisional sales manager, has been named assistant regional manager.

John Solberg, new southern regional manager, returns to the Rockies from Shreveport, where he has been Magcobar's district manager. Regional Manager Gregg Kildow II and newly promoted District Manager Bill Corser will now also locate in Denver.

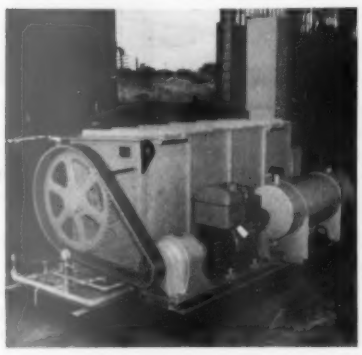
Monte Johnson has been named a district manager to supervise service to drilling operations in North and South Dakota. Newly promoted District Manager Earl Luther moves to Farmington, N. M., from Pampa, Tex.

Manager Bill Dahlem's district includes Utah, Colorado's western slope, and southern Wyoming. Dahlem is located in Casper, while District Engineer Don Akers headquarters in Grand Junction, Colo. Northern Mud's former offices in Billings will be occupied by Dave O'Connor, recently promoted to district manager. His district includes Montana, northern Wyoming, Idaho, and the Pacific Northwest coastal states.

Pug mill is made by Avondale

. . . Marine Ways, Inc., in New Orleans for Timcoat Corp., to be used in heating Timcoat ready-mixed aggregate for coating of pipe field joints. The asphalt mill consists of a lower insulated fire box utilizing single pass flow of gases under the mixing chamber.

The asphalt aggregate is introduced in the forward end, and is kept in constant motion by the rotation of 12 cast-steel paddle arms and blades. Flow of the material from the forward end to the outward door is controlled by either jacking up the forward end, or by altering the pitch of the paddle blades.



Power for operating the mixing blades is supplied by a 10-hp. diesel engine, which also drives a blower furnishing compressed air for the burner system. Heating is supplied by two burners.

Presently, Avondale has delivered four of the asphalt mills to Timcoat.

Robert G. LeTourneau selected

. . . by the military's Joint Chiefs of Staff to receive the 1959 National Defense Transportation Association's award, according to U. S. Secretary of Defense Neil McElroy. The award, scheduled for presentation October 14, identifies LeTourneau as the person "whose achievement contributed most to the effectiveness of the transportation industry in support of national security."

R. G. LeTourneau

LeTourneau spent more than 6 years developing an electric-wheel system for powering ultra-heavy-duty equipment—ranging from hugh rubber-tired trains for the Arctic to the world's largest road-building machines. He also designed rubber tires (10-ft. tall and 4-ft. wide) used on equipment built by his firm, R. G. LeTourneau, Inc., of Longview, Tex.

Macco completes construction

. . . in Houston on a building extension to increase manufacturing floor space by 250%. The new extension will produce parts for Macco Oil Tool Co., Inc.'s gas-lift valves, diaphragm motor valves, time-cycle controllers, automatic paraffin scrapers, and bottom-hole chemical-injection valves.

The Houston company is also completing an addition to a warehouse building which previously housed only part of Macco's motor-valve assembly and time-cycle controller testing equipment.

General Controls Co. forms

. . . an international division, designed to supervise and coordinate overseas activities, reports William A. Ray, president of General Controls. The division will headquarter at the firm's home offices in Glendale, Calif.

Remy H. Ludwig, former vice president and director of the international division of a mid-western controls-manufacturing firm, has been appointed director of the new division.

Air-Maze appoints Eads Co.

. . . factory representatives in Texas, announces W. B. Watterson, Air-Maze Corp.'s vice president in charge of sales. Headed by Ralph Eads, the new representatives have offices at Houston and Dallas. Eads has been a manufacturer's representative for over 12 years.

Ralph Eads

Eads will handle the application and sale of Air-Maze air and liquid filters, including filters for the gas-transmission and petroleum-processing industries.

George Antonic is appointed

. . . sales representative in John Fabick Tractor Co.'s Pipeline Division, reports Francis J. Fabick, company secretary. Antonic has 25 years' experience in heavy equipment. He spent several years as a pipeline trouble shooter.

Robert E. Halloran becomes

R. E. Halloran

. . . Pacific Coast sales manager of Babcock & Wilcox Co.'s Tubular Products Division, announces Leon B. Wohlgemuth, the division's general sales manager. Halloran, who will make his headquarters at Los Angeles, succeeds H. F. Lefferty, who is retiring after more than 40 years' service with Babcock & Wilcox.

Halloran joined the firm in 1941 as a student engineer, and later became a salesman in the division's New York district sales office. In 1953, he was appointed manager of mechanical sales for the division.

Oil Well Supply Division names

. . . two city representatives and two field representatives, reports William Miskimins, central-midwest area manager of the U. S. Steel Corp. division.

New city representatives are Ben A. Brooks, Jr., Midland, Tex., and Donald H. Schoonover, El Paso. Brooks, who has been with the division the past 2½ years, most recently was located at El Paso. Schoonover,

TOUGH— BUT NOT MUSCLE-BOUND!

Quaker Thermoid Fuelmaster Hose

A petroleum hose needn't be a brute to be tough. That's what's good about Thermoid-Quaker *Fuelmaster*—it's highly flexible and kink-resistant without being too tough to handle. But it lasts and lasts under the most severe weather and operating conditions.

Reinforced with tightly-braided high-tensile rayon cords in two- or three-braid construction, *Fuelmaster* has an extra-thick neoprene cover to withstand heavy abrasive wear. A static wire braided into the carcass can be grounded.

Use *Fuelmaster* as a fuel-oil, diesel-fuel, or gasoline hose. 1″ to 1½″ I.D., lengths of 100 to 175 feet. Ask your Thermoid distributor for Fuelmaster, or write to *Thermoid Division, H. K. Porter Company, Inc., Tacony & Comly Sts., Philadelphia 24, Pa.*

THERMOID PORTER DIVISION

H.K. PORTER COMPANY, INC.

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Specialty Alloys—RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H. K. PORTER COMPANY de MEXICO, S. A.; and in Canada, Refractories, "Disston" Tools, "Federal" Wires and Cables, "Nepcoduct" Systems—H. K. PORTER COMPANY (CANADA) LTD.

a 10-year company employe, will move to El Paso from Hobbs, N. M.

Newly appointed field representatives are Bruce L. Rhea, Gainesville, Tex., and Jackie R. Hunnicut, Hobbs. Rhea began with Oilwell in 1947. He will make the move to Gainesville from Garland, Tex. Hunnicut was employed by the division 4 years ago. Most recently he was located at Kermit, Tex.

Three store managers appointed

. . . by Jones & Laughlin Supply Division, announces A. G. Bastian, manager of field operations at Tulsa. Manager appointments involve J. J. Hoffman, Lake Charles, La., R. O. Dulaney, Worland, Wyo., and S. L. Easley, Best, Tex. All three were formerly salesmen at their respective locations.

Hoffman began his career with J&L as a store manager at Kilgore, Tex. in 1934. Dulaney joined J&L as a storeman at Winfield, Kans., in 1951. He later transferred to McPherson, Kans. as storeman. He became a salesman and transferred to Worland in 1956. Easley started with the division as a storeman at Sundown, Tex. in 1948 and transferred to Best in 1950.

William M. Martin is named

. . . assistant manager of gasket and packing sales, Industrial Division, Armstrong Cork Co., reports W. B. Tucker, general sales manager. Martin will work with A. J. Littlejohn, manager.

The newly appointed assistant manager served 5 years in the company's Cincinnati office as a salesman before being assigned to the general office at Lancaster, Pa., as a technical assistant in gasket and packing sales.

M. L. DeWoody named president

. . . of Clear Span Sales Co., Houston. Clear Span Sales is an affiliated company of Clear Span Engineering, Inc.

C.G. McLaren is appointed

. . . special representative with Southwest Supply Co.'s Tulsa office, announces John A. Bell, Jr., president of the Pittsburgh concern.

McLaren was formerly purchasing stores manager for Shell Oil Co., Tulsa. He recently retired from Shell after more than 35 years' service. McLaren has been associated in pur-

The benzene ring romance

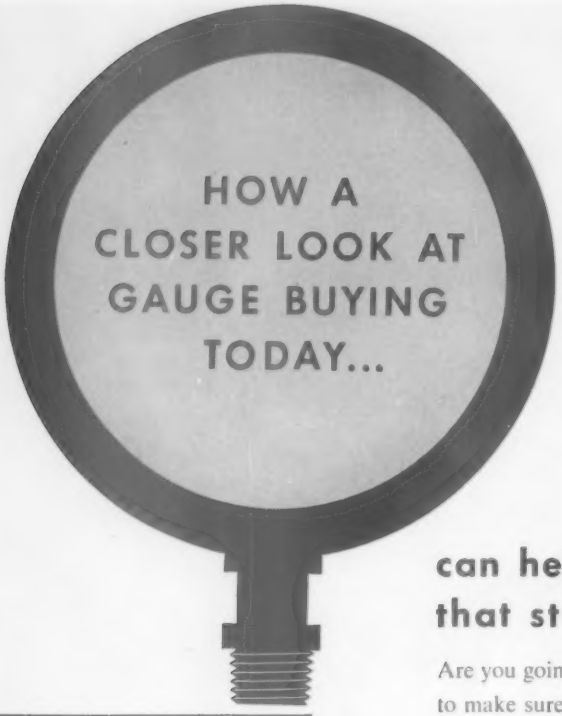
His proposal was outrageous. No wonder the boss was shocked! Use a precious metal at seventy dollars an ounce . . . in a catalyst shipped by the ton?

That, said the refinery man to the lady from the press, was how this remarkable Platforming® process started: A researcher at Universal had the audacity to propose, of all things . . . *platinum!* . . . as catalytic agent in a new reforming process.

In UOP Platforming, now widely used to produce benzene and other aromatic hydrocarbons, as well as high-octane gasoline, the platinum-containing catalyst proves phenominally active and long-lived. One pound of platinum treats 1,260,000 gallons of feed stock . . . and the platinum itself is never used up!

UOP scientists have for years been noted for imagination and courage in challenging the "impossible" . . . and their ability to convert these "impossibles" into practical, profitable processes that are vital to the refining industry. That is why refiners the Free World over depend on Universal for advanced techniques to cope with their ever-changing needs.

UOP®
UNIVERSAL OIL PRODUCTS COMPANY 30 ALGONQUIN ROAD
DES PLAINES, ILLINOIS, U. S. A.
More Than Forty Years Of Leadership In Petroleum Refining Technology



can help you pick gauges that stay on the job

Are you going to a higher price on gauges in order to make sure of gauge reliability? "Over-gauging" to get long life? It will pay to take a closer look at the size, flexibility, and high standards of accuracy of the United States Gauge line. At USG you can choose from over 50,000 standard indicating dial pressure gauges. Thousands of choices in case styles, sizes, materials, and in gauge components. Thousands of specials, too! Not only can you pinpoint your *reliability factor,* you can pinpoint your *price* for 99% of your gauge needs . . . from one line! It's easy to check . . . just call your USG distributor for your next gauge requirement. See the Yellow Pages, or write for catalogs and name of your distributor.

PICK exact Bourdon tube to meet stress, over-pressure, pressure range.

PICK Ni-Span "C" low pressure elements for exceptional thermal stability.

PICK Supergauge® for long life, accuracy to 0.5%.

PICK Solfrunt® for accuracy to 0.5%, solid-front safety from blow-outs.

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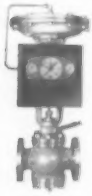
PICK Test Gauges for dependability, and accuracy as high as 0.2 of 1%.

PICK Recorders and Recording Controllers built to stand vibration, pulsation.

PICK A-Line for premium reliability, accuracy to 1%, and savings up to 40%.

PICK Arc-Loc® Movement for longer life, easier and lower maintenance.



PICK U. S. Gauge Indicating Controllers or Transmitters for reliability.

chasing circles throughout the Mid-Continent and southwestern areas for the past 20 years.

Evans, McIlhiney are named

. . . managers of the Cleveland and San Francisco district offices, respectively, of Du Pont's Petroleum Chemicals Division. Joseph G. Evans had been manager of the San Francisco district office for the last 5 years, while James G. McIlhiney most recently was a sales representative in San Francisco.

National Supply division moves

. . . to Columbus from Toledo. National Supply Co.'s eastern division is responsible for operation of supply stores in seven states, a pipe shop at Logan, Ohio, and a machine shop at Zanesville, Ohio. District offices are maintained at Olney, Ill., and Logan and Wooster, Ohio.

Robert F. Fox is appointed

. . . national sales manager of Eutectic Welding Alloys Corp., according to R. D. Wasserman, president of the Flushing, N. Y. firm. Fox, with the company the past 13 years, has served as district engineer and as regional manager for the corporation's New York-New Jersey area. A newly organized sales-management team will assist Fox.

Republic Supply Co. announces

. . . the appointment of Henry E. Bloch as machinery sales representative. He will be working out of the company's general offices in Oklahoma City.

Bloch was employed by Continental Emsco in 1950, serving as warehouseman, floorman, assistant store manager, and field salesman. Subsequently he was employed by Nelson Sales & Rental, Unit Rig & Equipment Co., and was with Mid-Continent Supply Co. as a district machinery representative at the time he joined Republic Supply.

Electronic Associates is named

. . . a manufacturer's representative for Radio Corp. of America mobile-communications equipment, according to R. C. Dubois, Jr., sales manager, RCA Communications Products department. The Midland, Tex. firm will handle such RCA mobile units as the Carfone, Personalfone, and Radio-Phone.

William T. Adams is advanced

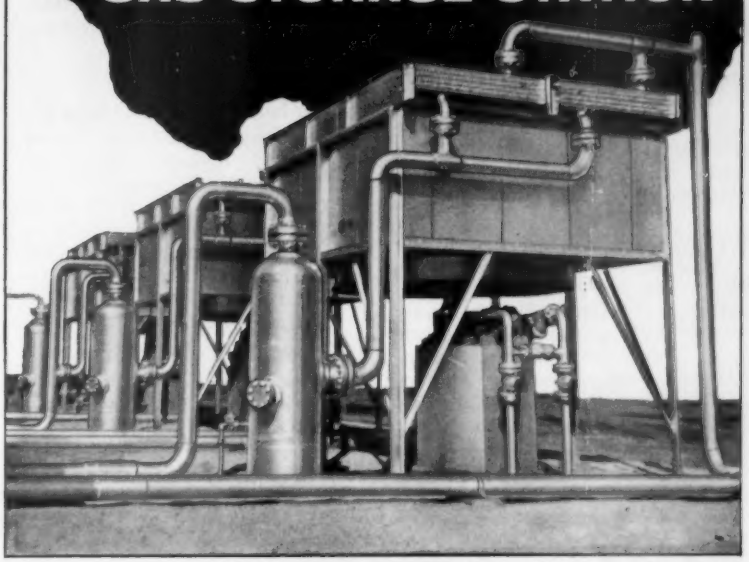
. . . to sales division manager in Canada by Reed Roller Bit Co., according to William E. Scarborough, domestic sales manager.

Adams started with Reed as a sales

HC® UNITS by Young

do double duty cooling at

TEXAS GAS STORAGE STATION



Pictured are three Young Radiator Company HC-1210 coolers handling Gas Inter-Cooling at the Tri Cities Station near Athens, Texas

The Lone Star Gas Company utilizes six HC atmospheric coolers by Young at their gas storage station near Athens, Texas. Three of these units cool Engine Jacket Water and Lube Oil on three 1350 hp Cooper-Bessemer 2-cycle Engines. The other three units do the Gas Inter-Cooling, and are designed to handle a total of 48 MMCFD to 78 MMCFD under varying conditions . . . up to 1500 psi working pressures. Young HC Units are built for rugged service. Their versatility means you get job-matched performance, according to the requirement of the heat transfer problem. Young Design and Engineering experience in the Oil Field, Petro-Chemical and Chemical Processing industries is yours for the asking. Call or write your nearest Young representative about your present or future Heat Transfer problems. No obligation of course.

OIL FIELD AND PIPELINE REPRESENTATIVES

1. Central Station Equip Co. Tucson, Arizona
2. Louis J. Cercone & Assoc. Buffalo 13, New York
3. Dutton-Williams Bros. Ltd. Calgary, Alberta, Canada
4. Flournoy & Everett, Inc. Downey, California
5. Jones and Laughlin Bradford, Pennsylvania
6. J. R. Mook Company Tulsa, Okla., Houston, Texas
7. Schneider Electric & Equip. Co. Omaha 8, Nebraska
8. Frank Walz Denver, Colorado
9. H. J. Young Muskegon, Michigan
10. Young Radiator Company Suite 213—205 W. Wacker Dr., Chicago 6, Illinois
11. Young Radiator Company Rm 407—51 E. 42nd St. New York 17, New York

"WHERE QUALITY COUNTS"

Write to Dept. 209-J for catalog No. 557

Young RADIATOR COMPANY
RACINE, WISCONSIN
Creative HEAT TRANSFER ENGINEERS
Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

clerk in 1952. He later served as assistant to the sales division manager in Carmi, Ill., before returning to Houston as product supervisor in 1955.

In 1958 Adams became salesman senior for the Texas Gulf Coast, and shortly thereafter was appointed special salesman. Six months ago he became assistant to the sales division manager for the southeastern division, with headquarters in New Orleans.

Frank C. Kuhn is named district

. . . manager at Calgary, Alta., where he will supervise the western region as representative for Petreco Division of Petrolite Corp. Kuhn, former service engineer for Petrolite Corp. of Canada, Ltd., takes over the duties of Grant Jarrell, who has been assigned to Petreco's headquarters at Houston.

Stone & Webster appoints three

. . . assistant vice presidents—two in Boston and one in New York—announces T. Cortlandt Williams, president of Stone & Webster Engineering Corp. Appointments involve Robert S. Boyd, appraisal manager; J. Marshall Hamill, administrative assistant in Boston; and Wilbur S. Roberts, Jr., manager of new business activities of New York.

Boyd was an engineer and later manager of Valuation & Real Estate Division of Pittsburgh Railways Co., from 1930 to 1955, before he joined Stone & Webster.

Hamill started with the firm in 1946 and has worked on the design of chemical and petrochemical plants in Great Britain and various parts of the United States.

Roberts headed the new business division since January 1958. From 1949 through 1953 he was assigned to Great Britain where Stone & Webster was erecting a petroleum refinery.

Cooper F. Hawthorne is named

. . . vice president and general manager of newly organized Metal Services, Inc., of the Beaumont-Port Arthur-Orange area, reports President J. H. Heslar. Hawthorne recently resigned from the same office, which he held for 3½ years, with Nowery J. Smith Co., Houston.

American Meter Co. to relocate

. . . two sales engineers in the southern district of its southwest division. Eugene D. Rouse is being assigned to the Houston sales office from Garland, Tex., and Clay G. Braswell to Garland from Houston. American Meter's southwest division was formerly known as Westcott & Greis, Inc.

Robert D. Denny is exec. v.p.

. . . of Cherokee Laboratories, Inc. He formerly was an officer and general manager.

At the same time, Ken D. Fisher was elected vice president in charge of sales, and Jack Woods, vice president of research and development. Martin Bellet is treasurer; Attorney Remington Rogers, secretary; and Miss Marilyn Stanton, assistant secretary.

J. B. Pierson will be chairman of the board. The office of president has been left open.

J. E. Haughn to represent

. . . Armour Industrial Chemical Co. in sales with headquarters at Houston, reports B. W. Graham, sales director. Haughn succeeds J. P. Badman.

In his new post, Haughn will be responsible for sales of Armour aliphatic organic chemicals in Louisiana and the eastern part of Texas. He has been with Armour since 1957 when he began in the market development

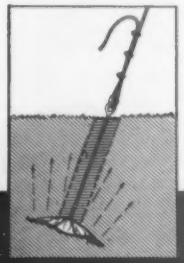
Save time and money... Get better guying with

Chance EXPANDING Anchors

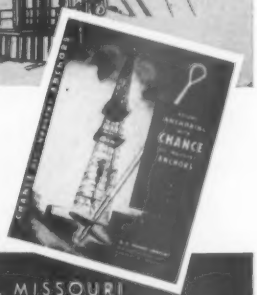
The Chance Expanding Anchor drops into a small hole and expands into solid earth in a fraction of the time required to bury old pipe or a concrete "dead man".

It will hold up to 30,000 pounds in firm soil.

Because the Chance Expanding Anchor can be installed in minutes, you save time and money, and because its holding power is distributed evenly over a wide area—you get better, more dependable guying for drilling and service equipment.

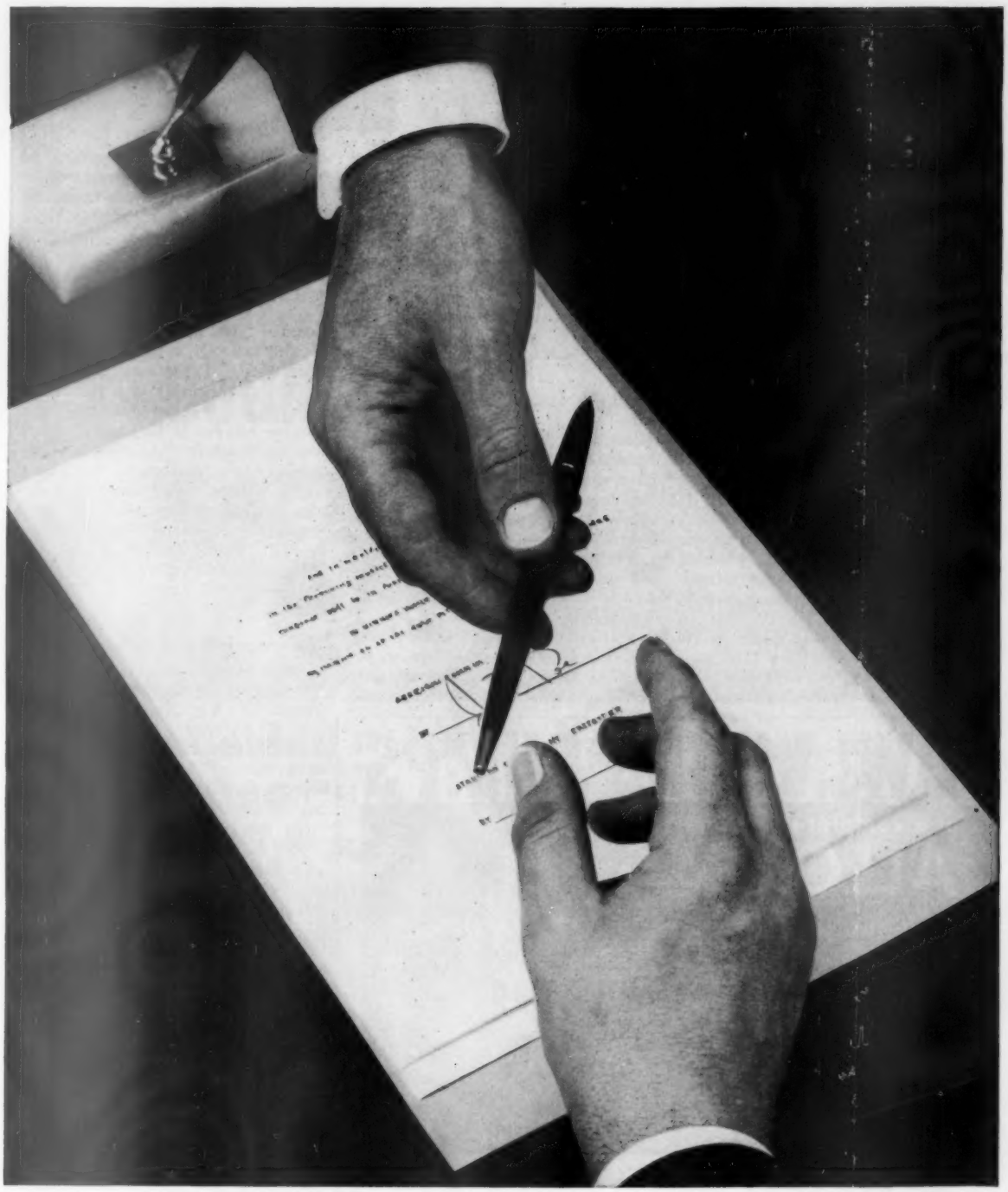


Load evenly distributed over a wide area due to square pyramid shape.



Write for catalog and price information. Sold through Oil Field Suppliers.

A·B·CHANCE CO. CENTRALIA, MISSOURI TORONTO, ONTARIO, CANADA



"Respect for contracts is a fundamental element of civilized life. Unless such respect is firmly established as a moral and legal rule, the economic stability and peaceful progress of the entire free world are inevitably hampered."

—M. J. Rathbone, President

Standard Oil Company (New Jersey)

and affiliated companies

department. He later was transferred to the derivatives department as a petroleum specialist.

Prior to joining Armour, Haughn was with the Texas Petroleum Research Committee and with a firm of consulting engineers.

Name change is announced

. . . following the consolidation of Rig Engineers & Fabricators Co., Inc., of Houston, with C&W Machine Works, Inc., of Great Bend, and Plainville, Kans., reports Floyd A. Cailloux, president of Rig Engineers. The new company will be called Systems Engineering & Mfg. Co., Inc., and will have home offices in Houston. The company will also use the Houston facilities and those of the two Kansas plants for manufacturing.

Systems Engineering will specialize in the design and fabrication of bulk-handling equipment, and will furnish equipment for various industries. It will manufacture both custom-designed and standard equipment for the transportation of powered, granular, or pelletized products through aerated piping systems under automatic control.

Cailloux, president of the company, announced that his staff will include: Galen T. Brown, executive vice president; Stan R. Scruby, sales and engineering vice president; Robert A. Hoover, in charge of sales and development of bulk equipment for the oil industry; and Charles Willis, vice president in charge of the Kansas operation.

New publications are announced

. . . by Cooling Tower Institute. Bulletins include: Redwood Lumber Specifications; Acceptance Test Procedure (for testing mechanical draft industrial towers); Nomenclature (of tower components, designs, and performance); Gear Speed Reducers; Pressure Preservative Treatment of Lumber; and Douglas Fir Lumber Specifications (Coast type). These publications sell for $1 each.

Other bulletins announced by Cooling Tower Institute include: Wood Maintenance, $1.50; Instrumenting a Field Study, $0.50; Recirculation (Summary of 7-years field study), $1; Recommended Recirculation Allowances, (no charge when ordered with Recirculation bulletin); and Appendix to Recirculation Bulletin (complete test data on 30 industrial towers included in the field study of recirculation), $5.

Special discounts are available on bulletins to manufacturers of water-cooling towers, and for quantity orders of $10 or more. Prices include prepaid postage. For orders of less than $5, prepayment is requested. Contact: Cooling Tower Institute, 1120 West Forty-third Street, Houston 18, Tex.

John W. Kennerly joins Flint

. . . Steel Corp. as sales manager of the warehouse division, announces W. P. Kissinger, vice president and sales director. Before joining Flint, Kennerly was with Schill Steel Co. of Dallas, and prior to that was assistant manager of warehouse sales for Maxwell Steel Co., Fort Worth.

Sauder Tank opens warehouse

. . . and sales office at Liberal, Kans., with Tom R. Dome branch manager. Before transferring to Liberal, Dome assisted in the development of gas-process equipment in Sauder's engineering department at Emporia, Kans.

Meanwhile, William C. Bailey was added to the Sauder sales force, and now fills the position of sales and serviceman at Sauder's branch office in Pratt, Kans. Prior to joining the company, Bailey spent 7 years with National Tank Co. at El Dorado, Kans.

J&L appoints two salesmen

. . . according to W. L. Wolfe, vice president in charge of sales, Jones & Laughlin Supply Division.

C. K. Ridgeway, a graduate of the division's sales-training program, will work out of Mexia, Tex. H. E. Reeves, salesman at Natchez, Miss., has been transferred to Laurel, Miss. After joining the division as a sales trainee in 1956, Reeves was assigned as a salesman at Brookhaven, Miss. He was transferred to Natchez earlier this year.

Clark Bros. opens turbo repair

. . . facilities at Beaumont. Located at the plant of Ideco, Inc., another Dresser division, the Clark operation is an extension of existing facilities for the packaging and final assembly of field compressors.

The repair shop is designed to assist users of Clark centrifugals in holding down time to a minimum and to give fast repair service during plant turnarounds. The shop is under the supervision of J. M. (Scotty) Smith.

McGurk is named sales manager

. . . for Thompson-Ramo-Wooldridge Products Co., in which post he will be responsible for managing the company's field sales organization. The announcement comes from TRW's marketing director, Raymond E. Jacobson. Dan L. McGurk joined the company a year ago as contracts and proposals manager.

(Continued on page 249)

NOW! VIKING PUMPS

in a complete line of

ALLOYS

Stainless Steel
Monel
Steel Nickel
Nodular Iron
Ni-Resist
White Bronze
and many others

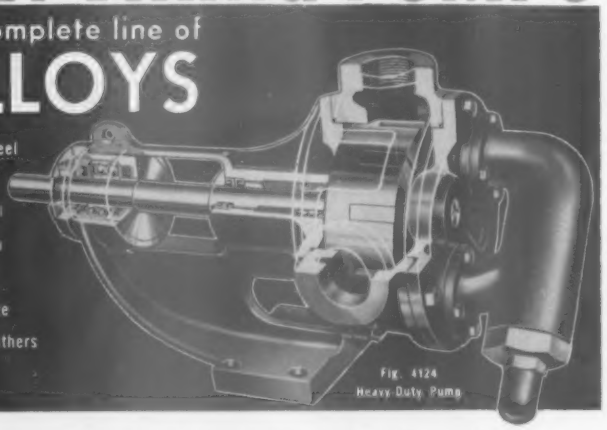


Fig. 4124
Heavy Duty Pump

Have problems of handling liquids and semi-solids of a corrosive nature, or where contamination is not permitted? Viking Rotary Pumps made of alloys to fit the need, will answer those pumping problems.

Available in a capacity range from ¼ to 300 G.P.M. and larger. New induction melting foundry facilities mean rigid control and faster delivery of the complete line of Viking alloy pumps.

Send your pumping problem to Viking today and ask for Alloy Pump catalog MT

VIKING — The Leader not a follower in Rotary Pumps

VIKING PUMP COMPANY

Cedar Falls, Iowa, U.S.A. In Canada, it's "ROTO-KING" pumps

Offices and Distributors in Principal Cities. See Your Classified Telephone Directory.

Homestead Plug Valves Help to Keep Aviation Gas Pure at Naval Air Base, Norfolk

3" Homestead Lubricated Plug Valves handling gasoline on tank truck loading docks at Naval Air Station, Norfolk

Aviation gasoline must be kept free of contamination. That's why fuel lines on truck or ship loading docks, and on underground storage tanks, are so often controlled by Homestead Lubricated Plug Valves.

Controlled pressurized lubrication system and extremely close tolerance between plug and body, prevent lubricant from being extruded into line—prevent contamination of gasoline. Add Homestead's reinforced Teflon* head seal and double ball check valve, and you have a truly dependable plug valve—one that opens quickly and fully for fast loading; closes quickly and tightly for positive fluid control.

Mail coupon today for Reference Books 39-1 and 1A, your complete library on Homestead Lubricated Plug Valves.

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HOMESTEAD VALVE MANUFACTURING COMPANY

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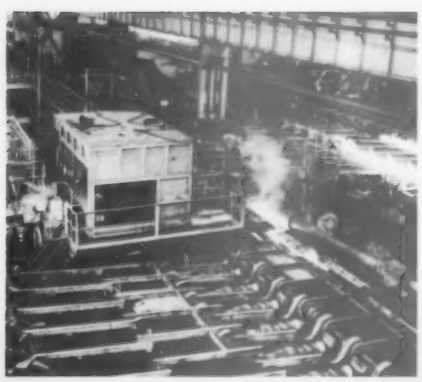
WHEREVER YOU FIND PIPE WITH ORANGE BANDS YOU'LL FIND A SMART PIPE BUYER



Youngstown's ultra-modern, fully-automated No. 3 Seamless Mill —now operating at our Indiana Harbor Works near Chicago— turns out the pipe with the orange bands, the finest made anywhere. Illustrated is the piercing operation at which point a hole is made down the middle of a solid round steel billet. Here is where Youngstown's quality and dependability is built into the pipe with the orange bands.

THE YOUNGSTOWN SHEET AND TUBE COMPANY *Youngstown 1, Ohio*

QUALITY
YOUNGSTOWN
SERVICE
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SEAMLESS DRILL PIPE · CASING · TUBING

Watch a BUCYRUS-ERIE transit crane at work!

Bucyrus-Erie Transit Cranes mount on 6x4, 6x6 and 8x4 carriers.

Discover the big edge in load control!

To make the right choice, *see* what these versatile machines can do. You'll see features in action that make Bucyrus-Erie Transit Cranes the best precision load handlers in the business.

As standard equipment, Bucyrus-Erie Transit Cranes offer you independent *power-controlled* lowering boom hoist for maneuvering the boom safely around machinery and pipe.

When you're working in a tight spot, setting up, you'll appreciate the friction swing brake that lets the operator hold both machine and load in the *exact* position you want, anywhere around the circle. There's no juggling for the next gear tooth . . . no jockeying of the swingers to hold steady.

You'll see many more features that make sense where safety and precision are concerned . . . where money and time savings are important.

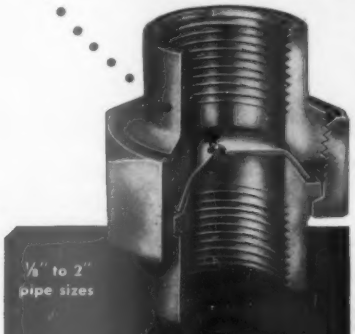
WATCH A BUCYRUS-ERIE AT WORK! Your distributor will gladly arrange the demonstration at your convenience. See him for full details, or write Bucyrus-Erie Company, South Milwaukee, Wisconsin, Dept. 34E.

BUCYRUS ERIE®

BUILDS BETTER EQUIPMENT

here's real **ECONOMY...**
time-saving **SIMPLICITY...**
and sure-fire **DEPENDABILITY**
for metering, measuring, controlling any piped material!

this Catawissa Cup-Orifice Plate CONVERTS any standard Catawissa Union into a ***GASKETLESS*** **ORIFICE UNION**



ELIMINATES the necessity of expensive gaskets...the uncertainty of what type gaskets are needed for specific temperature and pressure requirements... fumbling with extra parts!!!

Orifice Union problems of the past are gone forever! Stainless or carbon steel cup-orifice plate fits easily, quickly, securely to form a good, tight, leakproof seal. Temperature and pressure requirements are restricted only by the rating of the union itself (3000-lb. service, 9000-lb. test)!

Just specify "Catawissa Cup-Orifice Plates" or "Catawissa Cup-Orifice Unions" at your favorite supply store—or write for catalog and complete information.

CATAWISSA VALVE & FITTINGS CO.
CATAWISSA • PENNSYLVANIA

Schutte & Koerting adds

... stocks points at Houston and San Francisco to provide fast, nationwide delivery of standard jet ejectors, Rotameters, and flow indicators. These new points are in addition to the company's home plant in Cornwells Heights, Pa.

Equitable Equipment completing

... construction of a two-story living unit for Shell Oil Co. Upon completion, the all-steel, 30 by 35-ft. quarters will be skidded onto and mounted upon a barge for use in Shell's offshore operations in the Gulf of Mexico.

The unit, which will accommodate 16 men, is equipped with a galley, dining room, recreation room, and a heliport atop the roof.

Equitable Equipment Co., Inc. locates in New Orleans.

Atlas Valve Co. announces

... that Martin J. Noon has been appointed a sales representative in the Newark, N. J. area. Atlas, with headquarters in Newark, manufactures a line of automatic pressure, temperature, and level controls.

Ben Davison to head sales

... of precision test instruments, power supplies, wire-wound components, and custom industrial instrumentation systems of Electrodynamics Instrument Corp., announced President Joe Houghton. Before joining EIC, Davison served as branch sales manager for Koch Engineering & Sales Co. and as sales representative for Harrison Equipment Co., Inc.

James L. Callaway is appointed

... Houston area sales representative for Enardo Mfg. Co., Tulsa producer of oil-field specialties. Callaway formerly was with Payne Mfg. Co., Bethlehem Supply Co., and Halliburton Oil Well Cementing Co.

Company changes name

... from Pioneer Specialties, Inc., to Arrowhead Tool Co. The name change is the latest in a series of decisions made by the current management that assumed control several months ago.

Other changes have included reengineering the company's Quick-Change piston for slush pumps, completing new plant and production facilities, as well as overhauling distribution channels which now include 15 manufacturers representatives.

Tom S. Gillis serves as president. John Yerger, formerly with Oilwell Mfg. Co., California, is sales manager.

Call in a DURA MAN

for expert advice on mechanical sealing...

DURA SEAL

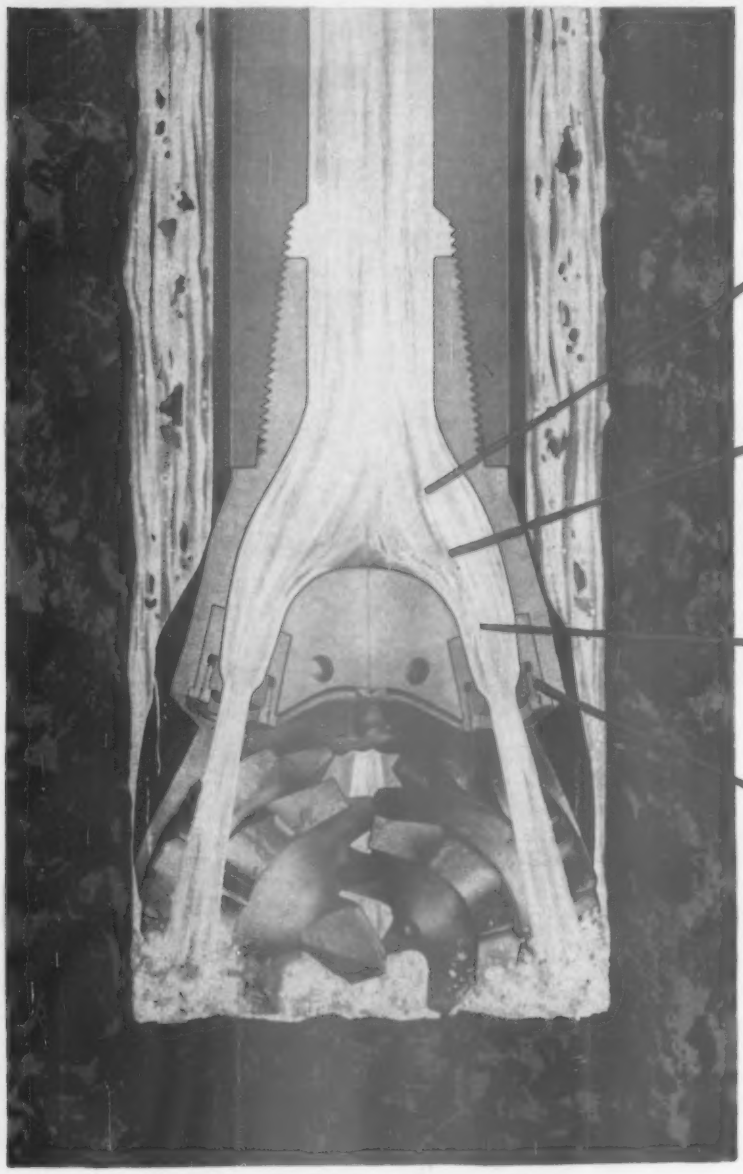
Sales and Service is Nation-wide

Mechanical sealing service at its best! Fifty-six trained men working out of thirty area offices offer assistance in meeting your sealing needs.

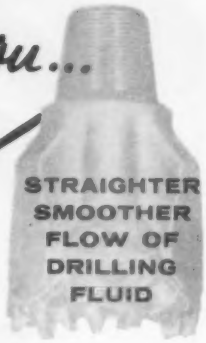
The PERFECT SEAL
TRADE MARK

DURAMETALLIC CORPORATION
KALAMAZOO, MICHIGAN

ONLY HCSmith
3-CUTTER JET ROCK BITS



give you...



STRAIGHTER SMOOTHER FLOW OF DRILLING FLUID

WITH MINIMUM PUMP PRESSURE

AND MAXIMUM JETTING ACTION

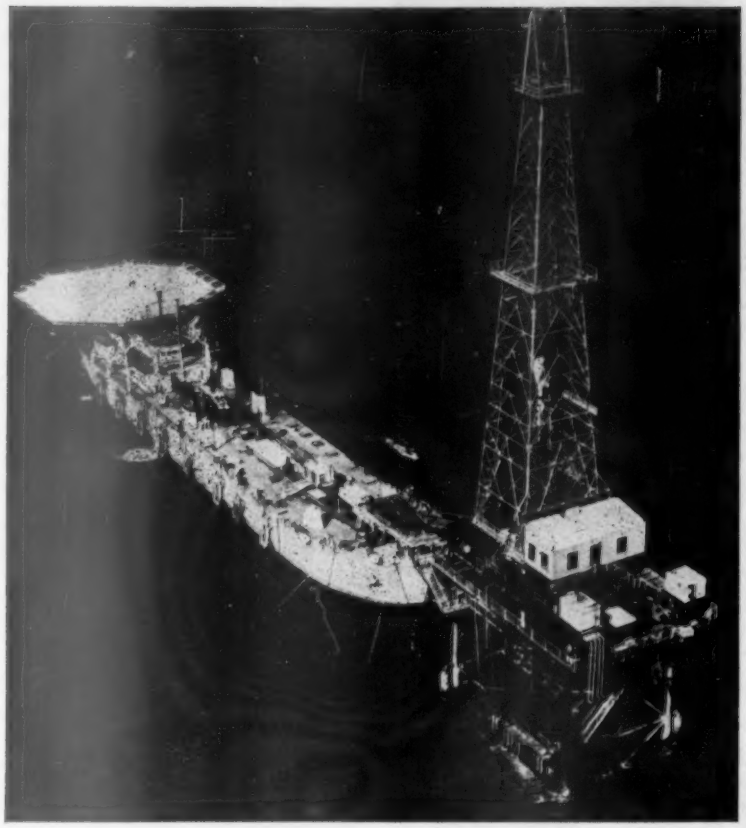
plus

FIELD-PROVEN THREADED FLOW NOZZLES FOR EASY INSTALLATION

HCSmith OIL TOOL CO.

Branches in Principal Oil Centers Throughout the World

COMPTON, CALIF. • ODESSA • HOUSTON • DALLAS • OKLAHOMA CITY • GREAT BEND • EDMONTON



This deep-drilling rig goes to the Gulf of Mexico as . . .

An-Son bolsters offshore fleet

A SUBSIDIARY of An-Son Drilling Co. of Oklahoma City, An-Son Offshore Drilling Co., has acquired the Deepwater Exploration Co. tender and rig known as Deepwater No. 1.

This unit has been placed in service on contract for Humble Oil & Refining Co. in Block 54, South Timbalier area, Gulf of Mexico.

The rig is a diesel-electric National 130E, equipped for drilling to depths up to 20,000 ft. This brings the total offshore operations of the company to three.

Imperial uses first air rig in Maritimes

A TECHNIQUE never before employed in the Maritimes of eastern Canada is being used for the first time by Imperial Oil, Ltd.

In this rolling hills country of southeastern New Brunswick, the company's five earlier wells were drilled with mud. Imperial is now using compressed air to drill its well on the banks of the Pollett River. Air drilling, although not new to the industry (having been used for several years), provides faster drilling, quicker recovery of core samples, and prolonged bit life in areas where relatively dry formations are prevalent.

The rig, brought from Alberta 18 months ago, encountered wet rock after spudding the new well July 2. Drilling mud was used for the first 700 ft. After changeover to air, the well is currently drilling below 1,500 ft. Ultimate depth of this venture is unknown at present as the company says it is impossible to tell now how deep the well must be drilled to encounter formations which will produce.

"SCOT" FORGED SEAMLESS RING GASKETS

MINIMUM HARDNESS

For ring Groove Flanges forged from reforging billets in the following materials in stock: Soft Iron, Copper, Aluminum, Inconel, Monel, Nickel; 1¼ Cr ½ Mo., 2¼ Cr 1 Mo., 9 Cr 1 Mo. 304, 310, 316, 321, 347, 405, 410, 430, 502, 304L, 316L, Nickel L.

Machined in all A.P.I.—A.S.A. Special sizes and other type, Including BX.

Ask for "SCOT" Gaskets at your Supply Store.

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STEEL BARGES for Charter

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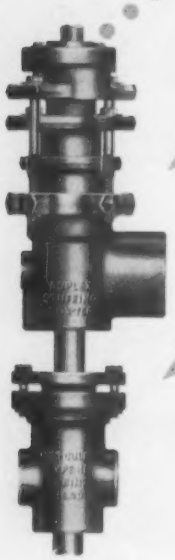
slim hole EQUIPMENT

FIRST from HERCULES

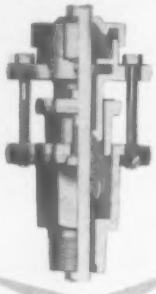
HERCULES is First to provide a complete line of equipment for this new Oil Production Technique.

The use of 2½" tubing for casing and 1¼" or 1½" tubing as the oil string has made it necessary to develop new equipment specifically for this purpose. In response to the requests of production men, Hercules now provides tested and proven production equipment for Slim Hole Drilling. The well-known Hercules "Tee-Type" Duplex Stuffing Box and the new 2½" Hercules Type "HF" Tubing Head are incorporated in this typical Slim Hole well hook-up. Hercules "Tee-Type" Duplex Stuffing Box is now available in 1¼" and 1½" tubing sizes (plain or EUE) with the same packing and parts used in all Hercules Duplex Stuffing Boxes.



HERCULES "TEE TYPE" DUPLEX STUFFING BOX A combination Tee and Stuffing Box with female thread to screw directly onto the 1¼" or 1½" tubing, eliminating one-threaded connection and resulting in a considerably shorter hook-up. 3000 PSI test. Approximate height 15". Weight 33#. Price $31.00.

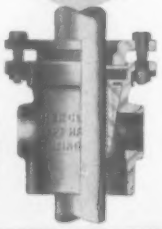
HERCULES TYPE "HF" SLIM HOLE TUBING HEAD Features the safety and quality that you receive in all Hercules tubing heads at a minimum price. Pressure cast, one piece steel body with 2" side outlets and heat-treated hinged slips. Over-head packed with neoprene packing. 1000 PSI test. Height 8½". Weight 19#. Price $49.50.



HERCULES "REGULAR TYPE" DUPLEX STUFFING BOX Proven design and dependability render this stuffing box unequalled for the difficult pumping situations as well as easy ones. Constructed from malleable iron, it protects workers from the danger of shattered metals should rods accidentally drop. The new 1¼" or 1½" "Regular Type" Stuffing Box is ideal for use in Slim Hole installations.

HERCULES TYPE "DS" PUMPING TEES In the 1¼" and 1½" sizes these Tees are ideal for use on Slim Hole well hook-ups.

HERCULES TYPE "HF" TUBING HEAD In spite of its economical price, the Type "HF" Tubing Head is pressure cast with one piece cast body and Overhead Packed with neoprene Packing Ring. This Head is now available for 2" or 2½" Tubing to suspend ¾" to 1½" Inner String (Plain or EUE) for Slim Hole operations.



All Hercules Products for Slim Hole Drilling may be purchased through the supply store of your choice. Write for complete information.

HERCULES TOOL COMPANY

Manufacturers of Oil Field Equipment

GENERAL OFFICES AND PLANT • TULSA, OKLAHOMA

Export Representative Oil Field Equipment Co., Inc. 90 West Street, New York, N. Y.

Truck pulls rig on wheels

A rig on whels, for drilling to 5,000-ft. depths and flexible enough to be moved on level or rolling terrain to new sites within a matter of hours, has been placed in service in eastern Alberta by General Petroleums Drilling Co., Ltd.

It is equipped with four wheels, mounted at rear of the platform. While working, it rests on a conventional foundation. To move it, a hydraulic lift raises the substructure, a heavy-duty tractor-truck backs under one side of the floor, and is hooked to the rig. The derrick remains erect.

The device was engineered by Cunningham Engineering, Ltd., and built at General Petroleum's Highfield shops in Calgary. The rig weighs 70,000 lb. and is designed for use in Alberta and Saskatchewan. It's first job was at Bassano, Alta., for Canadian Pacific Oil & Gas Co.

Texas Land & Exploration opens Corpus Christi office

Texas Land & Exploration Co. has announced the opening of offices at 541 Wilson Building, Corpus Christi, on September 1.

The firm will operate its own drilling rig and will engage in drilling both contracted and company-owned wells. The company owns 5,000 acres located throughout South Texas, and will actively engage in exploratory work on these tracts and other leases.

Drilexco slated for Libyan operations

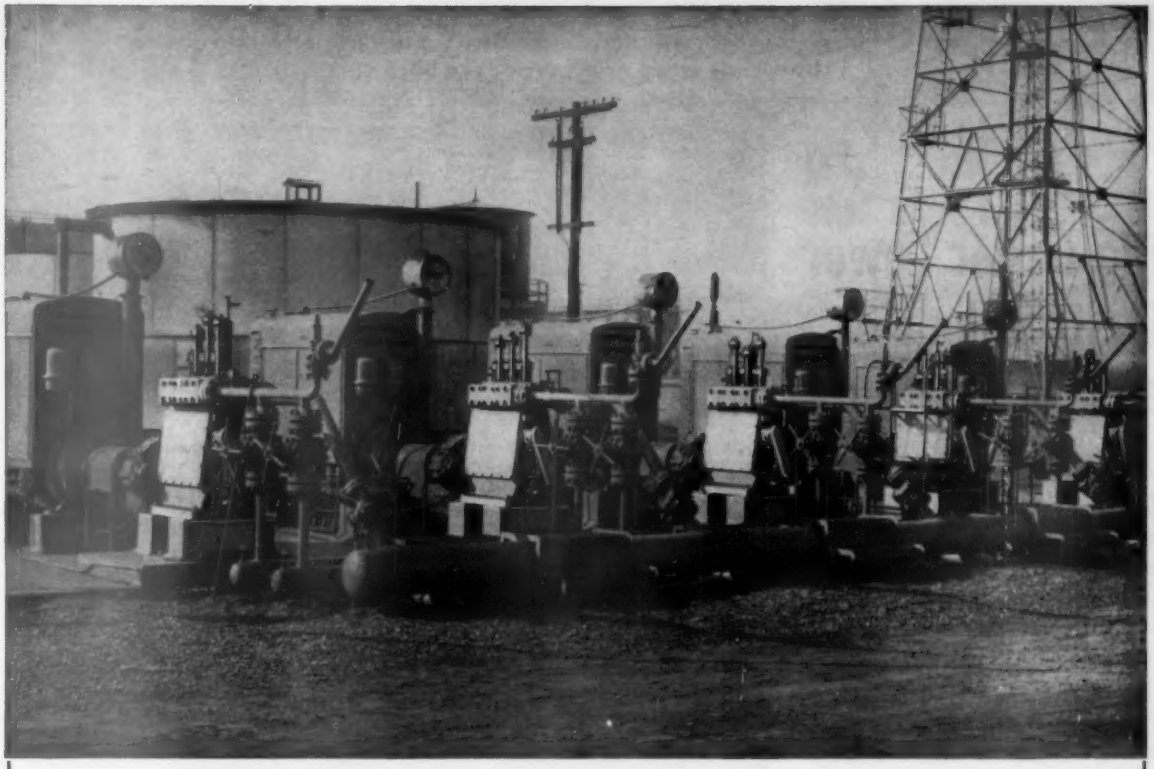
DRILLING & Exploration Co., Inc. has announced the completion of negotiations with Oasis Oil Co. whereby Drilexco will soon begin drilling operations in the Kingdom of Libya.

Drilexco will drill a series of exploratory wells for Oasis, a foreign subsidiary of Ohio Oil Co.

A National 100 is being moved from Pesaro, Italy on the Adriatic coast for the Libyan operations. Actual drilling is expected to begin in early December. For the operation, Drilexco is purchasing new camp and transportation equipment in the United States to be shipped to Libya.

Oasis is one of the major operators in Libya. Primarily this firm has concentrated its efforts in North Central Libya where it has three good wells in the Sirte basin.

The negotiations with Oasis further extend Drilexco's operations in the Eastern Hemisphere, where the firm currently has operations in Holland, Turkey, Iraq, Nigeria, and Africa.



FIELD REPORT

FLOOD: Hellman-Reyes
Dominguez First East Central

OPERATOR: Union Oil Company of California

PUMPS: Five Aldrich Triplex

FLOODING STARTED: July, 1954

EXPERIENCE TO DATE:

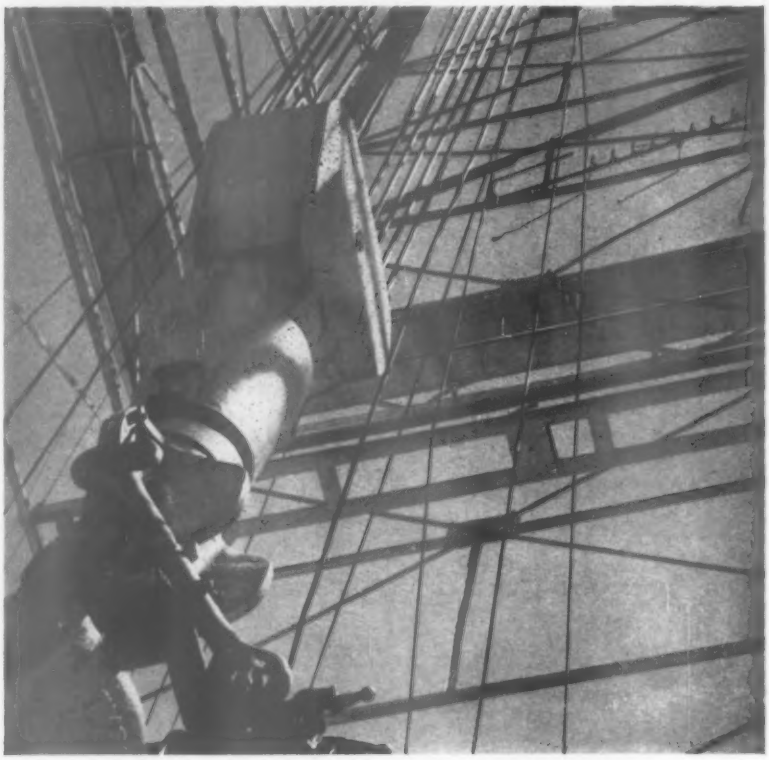
Pumps are in continuous service, delivering 10,000 B/D at 1300 psi. Customer reports: "No mechanical breakdowns of any type on these pumps...plunger packing and valve discs replaced only once to date."

Field parts stock available in Carmi, Ill.; Casper, Wyo.; Charleston, W. Va.; Houston; Los Angeles; Odessa and Tulsa. For further information, write the Aldrich Pump Company, 9 Gordon Street, Allentown, Pa.

the toughest pumping problems go to ALDRICH

What is more important for efficient, economical drilling and completion than your mud and cement programs?

Rig up for Lower Cost Drilling and Completion... with DRISCOSE* and DIACEL**



Let us give you the benefit of experience gained over many years on thousands of wells. **Drilling muds and cement systems are our only business.**

Profit from the continuing development work done in our laboratories as well as from the assistance of our experienced field engineers. Our knowledge of up-to-date techniques can help you keep drilling and completion costs at a minimum.

For complete details . . . for the name and location of the nearest Drilling Specialties Company field engineer—write or call today.

Technical Literature

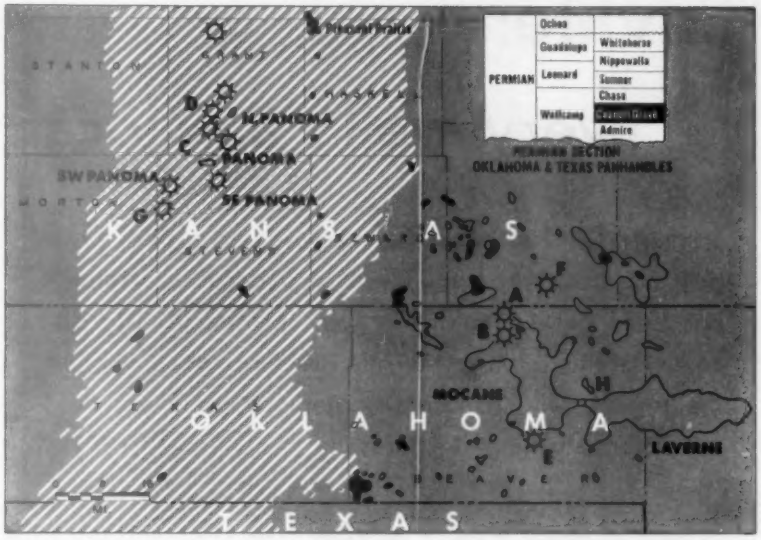
Driscose . . . The Versatile Drilling Mud Additive—Just published . . . a complete survey on Driscose High-Purity Mud Additives. Up-to-date information on the latest mud techniques. Write for your copy of this bulletin, D-20, today.

Also, complete DIACEL cementing literature, data and technical reprints are available.

**A trademark

*Driscose is a trademark for Sodium Carboxymethylcellulose

DRILLING SPECIALTIES COMPANY
Bartlesville, Oklahoma



GAS DISCOVERIES in the Council Grove-Permian group dot the Panhandle region of Oklahoma and Kansas as operators seek out this new target, only a few hundred feet deeper than the old established pay in the Sumner and Chase-Permian groups. Gas-well symbols and lettered areas represent recent strikes in formations of Council Grove age.

Panhandle operators reap a second crop

BY FRANK J. GARDNER

OPERATORS in the Panhandle region of Kansas and Oklahoma have made a belated discovery: there's more than one good pay zone in the Permian section there. In the heyday of discovery and development of the old Hugoton gas field, every bit was aimed at the Sumner and Chase groups for final completion. Now, 30 years later, and only a few hundred feet deeper, a second major gas reservoir has captured widespread attention. It's the Council Grove group, immediately underlying the Chase.

A slow beginning . . . It all began back in 1955, when Lion Oil Co. 1 Hodges opened Northeast Forgan field in Beaver County, Oklahoma (Section 21-6n-24e), shown at A on the map. The following year saw only two more Council Grove strikes; these were Carter Oil Co. 1 State-Hodges Unit, in Section 4-5n-24e, Beaver County, Oklahoma (B on map), and the discovery well of Panoma field in northwestern Stevens County, Kansas, Hugoton Production Co. 2-12 Panoma, Section 12-31s-38w (C on map).

In 1957, the Council Grove failed to pay off at all. But in 1958, two more fields were found at North Panoma (Hugoton 2-33 Hindmarsh, Grant County, Kansas, Section 33-29s-37w), and at Southwest Panoma (Hugoton 2 Cavner, Stevens County, Kansas, Section 35-31s-39w).

And a fast followup . . . This year, the Council Grove fever has spread rapidly. Discoveries are coming so fast it's hard to keep a map current. At least 10 new pools have been found in the past few months. Five are in Grant County (D on map), two in Stevens (G on map), and one in Meade (at F) to round out the Kansas score.

On the Oklahoma side, Beaver County came up with a highly important Council Grove discovery on the southern edge of fast-growing Mocane field. This was Cities Service Oil Co. 1 Meek "A" (at E on the map); it potentialed for 10,200 M.c.f. per day from perforations at 3,330-3,550 ft. It's the southernmost and deepest Council Grove producer found so far, and lies nearly 100 miles southeast of another significant northernmost find in northwestern Grant County, Kansas.

Mean a second crop . . . What does all this mean? It means simply that an entirely new blanket of gas is being unfolded all over the Hugoton embayment, and at depths **above** 4,000 ft. The depth of pay in the Council Grove ranges from 2,863 ft. in Grant County, Kansas, to 3,550 ft. in Beaver County, Oklahoma. This "second crop" of natural gas can mean a great deal to the "shallow-lease" operators throughout the region. Previously, most Hugoton production has come from the Sumner and Chase groups at depths of 2,900 ft. or less.

Here's a complete reversal of interest for established producers in Hugoton and related fields. Since 1954, attention has been focused on the ultradeep pays believed to lie in pre-Permian formations. This has brought rich rewards, of course, in the way of new pools in the Pennsylvanian and Mississippian sections, and it has yet a long way to go before the true potential is realized. But here, in the Council Grove section, we have a new **shallow** target that can be even more rewarding.

This emergence of a new quarry in the Panhandle region of Oklahoma and Kansas is just one more facet of one of the most amazing drilling centers in the United States today. Perhaps no place in the country is as busy (or as successful) as this western part of the Anadarko basin.

Observers in the area are hard put to keep up with all the activity. One seasoned oil writer, whose full time is devoted to its coverage, puts it this way: "This area is continually surprising in the developments which occur from one day to the next. I have covered the Permian basin, North Texas, West Central Texas, and East Texas, but I have never seen anything else like it."

It's a pretty sure thing that we'll see more here than we've seen so far. At H on the map, for instance, we're seeing the vast Mocane and Laverne fields slowly coalesce; only one barren section separates the two. Watch for more of the same.

Southwest Enville:

Every well's a wildcat

Southern Oklahoma has been considered a poor prospect for structural traps for over a decade; emphasis has been purely on stratigraphic prospects. The discovery of the Southwest Enville structure has shown that the region, with its complex geology, may yet hold even more startling structures.

BY C. C. REEVES, JR., W. T. PROBANDT, AND T. A. CULLINAN

SOUTHWEST ENVILLE'S structural complexities are of such a nature that several fault patterns are readily suggested by the normal investigative means. For this reason the senior author, in cooperation with several of his subsurface geology students, constructed a peg model of the field area with a horizontal scale of 1 in. equal to 220 ft., vertical scale 1 in. equal to 300 ft., basal datum being 15,000 ft. This gives a field model 4 ft. square, with each section 1 ft. square. The wells are represented by ½-in. wood dowels which extend 50 in. to sea level.

The authors feel that by using this peg model they have been able to accurately unravel the structural maze of Southwest Enville and arrive at the best possible solution, though several questions are as yet unanswered.

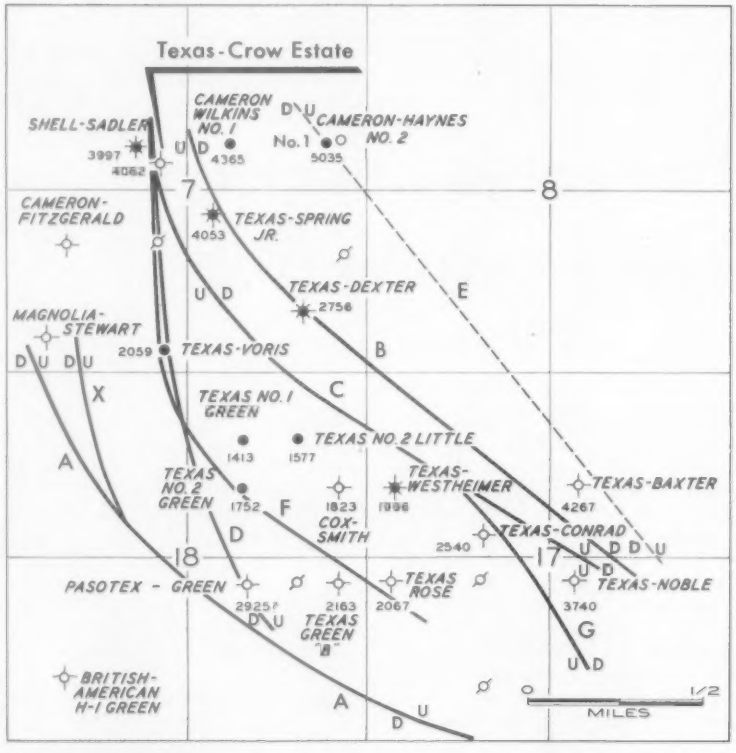
The relation of the large thrust zone (fault X-A) to the regional picture, the suggested faulting in the Cameron Fitzgerald and the Magnolia Stewart—these are of vital interest to persons interested in carrying production to the west by searching for the basal Oil Creek sand pinchout.

Field Structure

Southwest Enville, on the central Wichita-Criner Hills arch, is on trend with the prolific Empire-Comanche-Palacine - Loco - Healdton - Northeast Greenville fields, and the Sandusky and Sherman fields of Grayson County, Texas.

Structurally the field is a hodgepodge of displaced anticlinal fault blocks, some horsts, others grabens, which well represent deformation and fracturing due to upwelling of the basement complex. Initial structure was no doubt a large horst block immediately overlying the basement welt, subsequent faulting producing the present picture.

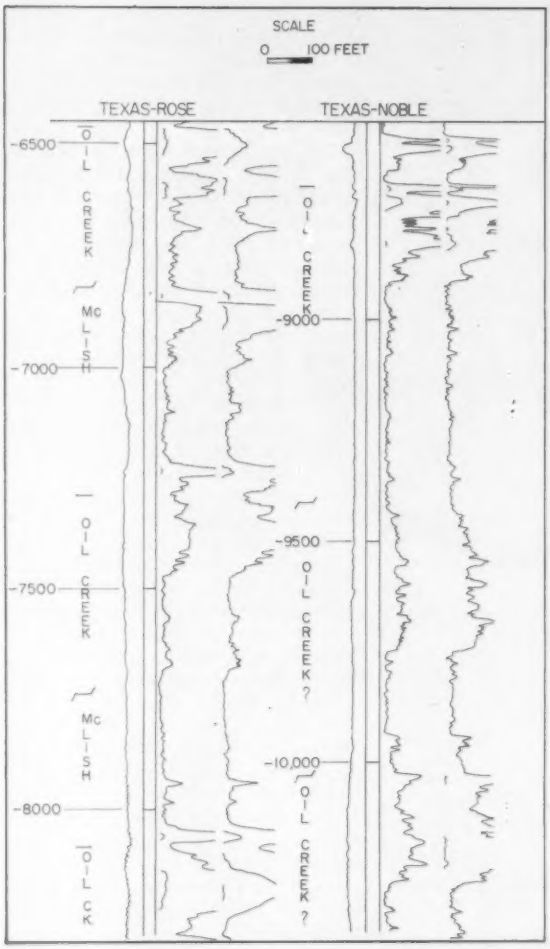
First indication that Southwest Enville would be structurally complex came with the drilling of 1,750 ft. of Viola limestone and 750 ft. of Tulip Creek in the discovery well. Shortly thereafter the Texaco 1 Noble and Rose were spudded in, and 1 month later the Dexter.



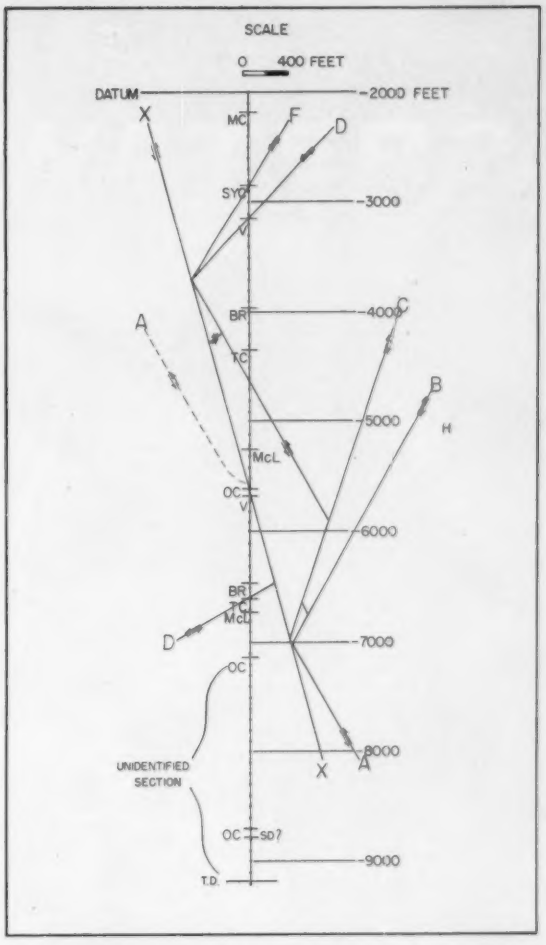
EARLY INDICATIONS were that this structure was a simple anticline. Faulting patterns later proved it was a structural maze. Fig. 3.

A three-well race . . . Since the Noble was to top basal Oil Creek sand pay first and because of the high pressures and resultant trouble experienced in the discovery well, a Baroid "gas buggy" was installed. The Rose was expected to top pay shortly after the Noble with the Dexter following the Rose. Thus it was planned to move

Part 1 of this article appeared in the August 31 issue of The Oil and Gas Journal.



HOW THRUSTING affected these two Texaco wells (see Fig. 3) is apparent from their electric logs. Both wells were dry. Fig. 4.



FAULT DEVELOPMENT in the Texaco 1 Voris is a classic example of interpretive problems. Fig. 5.

the "gas buggy" from Noble to Rose to Dexter, an economy measure which very nearly cost another blowout.

By the first of June 1957, the Dexter had reached basal Oil Creek sand pay and was shut in at 8,674 ft. to prevent a blowout. On the other hand the Noble, with "gas buggy" still attached, was drilling in the Oil Creek formation searching for the basal sand pay, even though the well was by now 4,508 ft. lower than the Dexter. The Rose was at this time drilling in basal McLish at 6,330 ft.

By the end of the summer, completion of several wells had turned what at first was thought to be a simple anticline with 2,000 ft. of relief (The Oil and Gas Journal, June 17, 1957) into another typical southern Oklahoma oil field replete with numerous faults and their consequent problems.

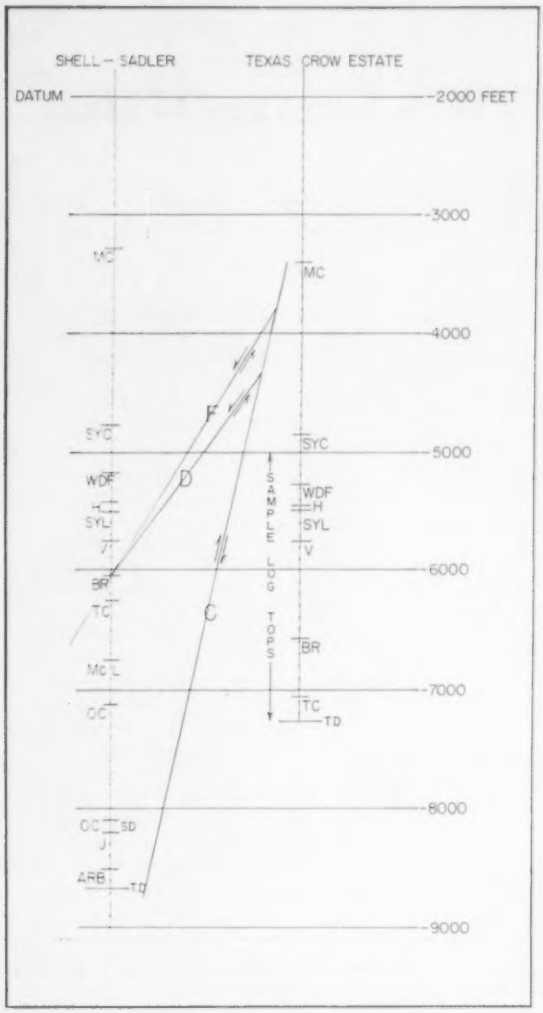
The most distinctive and costly fault of the field is undoubtedly the thrust which serves as the field's southern limit (Fig. 3). Because of multiple repetition in wells cut by this fault, a zone of thrusting is suggested. Dip of this thrust zone, calculated from its intersection of Oil Creek in the Texaco 1 Noble, Rose, Green, and Voris, coupled with its missing the Westheimer, is approximately 50°-60°.

Because of unidentified sections, individual throws could not always be calculated; however, the authors believe that several thousand feet is necessary (Fig. 4). Though no means of dating the thrust zone are available in the field area, it is felt that regional studies will show it as the boundary between the Marietta syncline and Criner Hills provinces.

Sections repeat . . . The complexities of Southwest Enville faulting are best exhibited in the Texaco 1 Voris. It drilled an abbreviated Sycamore section and then went directly into Viola limestone. The Viola and Bromide were normal but the Tulip Creek was abnormally thick. After topping the Oil Creek formation, pay was expected within the next 1,000 ft., but after cutting only 70 ft. of Oil Creek limestone the well went back into Viola limestone. Nearly the same uphole thickness of Viola was again drilled but an abnormally thin Bromide and Tulip Creek section followed.

The Voris then drilled out of Tulip Creek and into a normal McLish section and once again topped Oil Creek limestone. The basal sand pay was again expected within the next 1,000 ft. but an additional 1,550 ft. was cut before anything even remotely resembling the basal Oil Creek sand appeared (a shaly limestone). Total depth was 9,180 ft., 2,050 ft. below the second Oil Creek top. The faulting at the Voris location is shown in Fig. 5.

Of considerable interest is the large thrust which has put 70 ft. of Oil



CROSS-SECTION from the Shell 1 Sadler to the Texaco 1 Crow Estate indicates complexity in short distances. Fig. 6.

Creek limestone over the Viola formation, a throw of approximately 2,200 ft. This thrust, fault X-A of Fig. 3, represents the northernmost extension of the indicated thrust zone (Fig. 3) and consequently the southwestern limit of the original Southwest Enville horst.

Fault dating difficult . . . Determination of relative ages for the faults is quite a problem. For instance, even with the tight control in the Shell 1 Sadler-Texaco 1 Crow Estate area, a relative age is indeterminate.

The Sadler is a normal well except for the omission of 840 ft. of Viola-Bromide section.

The Crow Estate is also normal to total depth in the Tulip Creek section. Because of the dip of thrusts C and B, they might be expected to cut the Crow Estate. Since the well is normal, the thrusts must lie to either side; however, with only about 100 ft. of displacement between the wells, it is doubtful that a thrust separates them.

Since both the Sadler and the Crow Estate are at nearly the same elevation down to the Viola top, it seems mandatory that the normal passing through the Viola-Bromide section dip to the east. If the dip is to the east the fault (D) would be expected to appear in the Crow Estate unless dip is steep enough to miss the well. Assuming that the dip is such that intersection is possible, then obviously the normal is intersected by one of the thrusts, either B or C. This would mean that fault B or C is younger than D.

Fortunately the Viola-Bromide fault of the Sadler may be traced to the south. The two normal faults which appear in the Texaco 1 Voris, one at the top of the Sycamore and the other at the top of the Viola, undoubtedly correlate with the normal of the Sadler, thus suggesting two normals in the Viola-Bromide section of the Sadler, one with a throw of 240 ft. (fault F) and the other with 600 ft. of throw (fault D), or at least one normal fault with the combined throw of 840 ft. by the merging of the previous two.

Tracing farther south, a normal fault of 600-ft. displacement is found at the top of the Sycamore of the Pasotex Green, but now the small normal of 240-ft. displacement is beneath the larger normal in the Woodford shale. In order for the larger normal to cut out part of the Sycamore and displace the Mississippi Caney, the dip must here be to the west.

Establishment of a western dip creates two problems. First is the position reversal of the smaller normal, second is the placement of a fault with 840 ft. of throw between two wells that show less than 100 ft. of displacement.

Obviously, the smaller normal, fault F, must cross fault D, forming a conjugate fault system. With dip of fault D determined as west, it must pass between the Shell Sadler and the Texaco Crow Estate until it is intersected by the larger thrust, fault C. Thus the 840 ft. of normal displacement is offset by the 750 ft. of thrust of fault C, except for the 100 ft. which now remains.

This then means that the thrusts, faults B and C, are younger than normal faults D and F, and also younger than thrust A which intersects the Tulip Creek section of the Voris.

The only evidence for placement of fault E is removal of 240 ft. of Sycamore in the Cameron Haynes and of 100 ft. of Hunton in the Texaco 1 Baxter. If one fault is used, then it must exhibit a change in throw to the southeast. For lack of better evidence at this time the authors suggest one fault with this peculiarity, in an attempt to minimize the structural complexities.

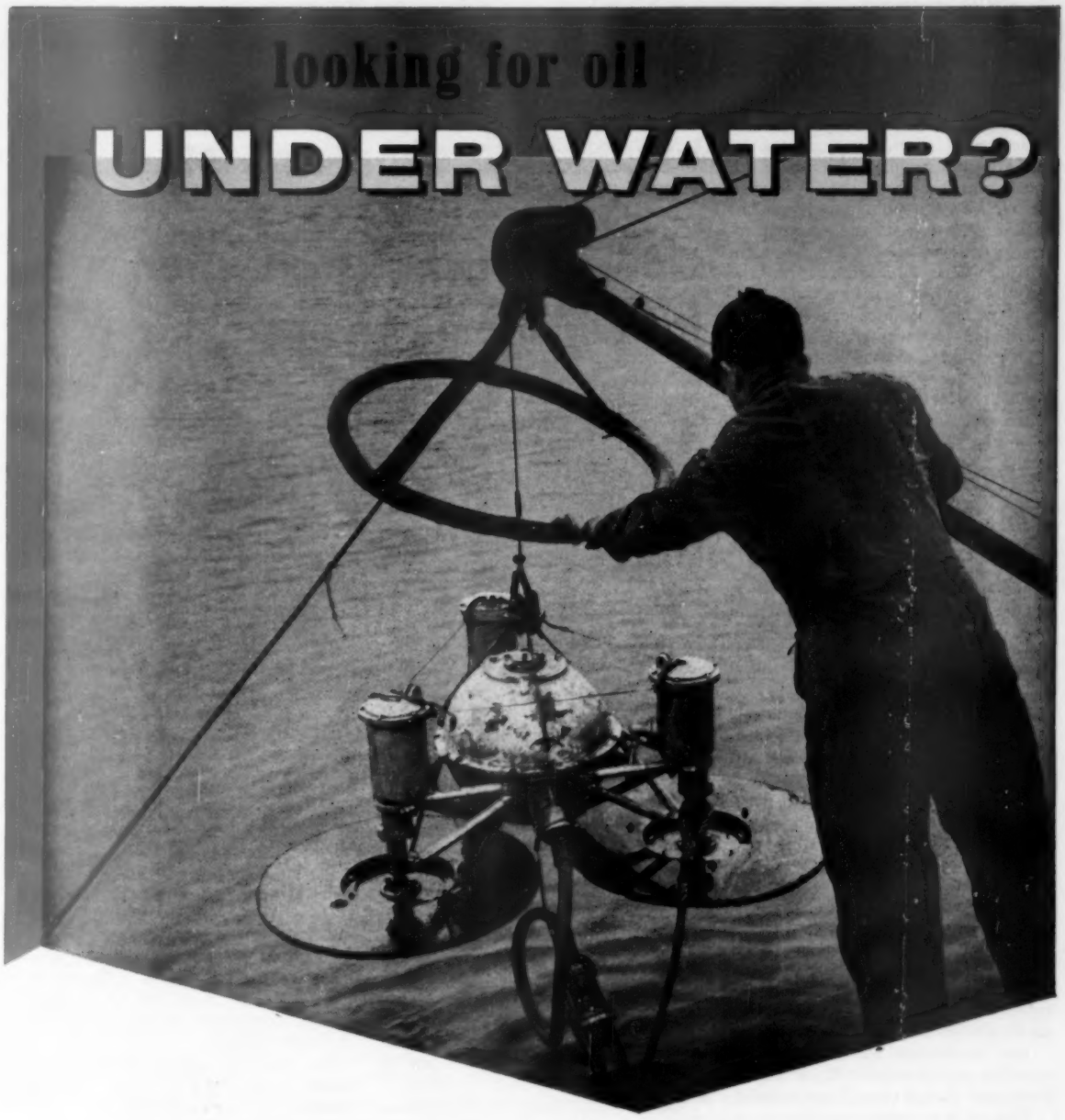
Future Prospects

Significant basal Oil Creek sand discoveries have been made to the north, northeast and northwest. The Sinclair 1 Tucker, 32-6s-3e, flowed 4 M.M.c.f.d. of gas plus 389 bbl. of distillate in 24 hours through a 12/64-in. choke.

To the northeast, the Pasotex 1 Brannan 3, 3-7s-3e, flowed 20 M.M.c.f.d. of gas with 90 bbl. of distillate per million on drill-stem test opposite basal Oil Creek sand.

The Sun 1 Brahma, 35-6s-3e, flowed 13 bbl. of oil per day through a 1-in. choke opposite basal Oil Creek sand.

In March 1959, Viola production



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was established to the north of the original Southwest Enville area. It seems quite probable that the field limits will be greatly extended in all directions, perhaps even filling in the gap between Northeast Greenville and present production. Extensions to the east are questionable at this time.

The numerous basal Oil Creek sand discoveries surrounding Southwest Enville suggest a series of buried structural trends which parallel the main Wichita-Criner Hills arch. If this be the case northeastern Love and western Marshall counties can look forward to unprecedented development.

Of greatest interest is the probability of extending basal Oil Creek sand production to the west. As previously stated, the discovery well was placed in an attempt to locate the strand line of the basal Oil Creek sand. Obviously, the discovery of 80-100 ft. of sand shows that the strand line lies farther to the west, though this at first might seem somewhat discouraging since the presence of the Marietta syncline would cause a downdip pinchout.

One of the areas most significant tests is the Pasotex 1 Brannan Unit 5, basal Oil Creek sand producer of 27-7s-2e. This test, and others, produce from a structural trend south of Southwest Enville field. Thus if fault zone X-A serves as the boundary between the Criner Hills arch and the Marietta syncline as the authors have herein suggested, then an important oil-producing trend has been found.

Conclusions

Southern Oklahoma has been considered a poor prospect for structural traps for over a decade; emphasis has been purely on stratigraphic prospects. The discovery of the Southwest Enville structure has shown that the region, with its complex geology, may yet hold even more startling structures.

The Southwest Enville discovery must be considered of major importance for several significant reasons.

First, it has stimulated interest in that part of southeastern Oklahoma covered by the Cretaceous overlap.

Second, it once again emphasizes that areas which have been "tested" by wells not reaching basement have not been adequately evaluated.

And third, adequate evaluation of any area not only requires wells to basement, but a close well spacing.

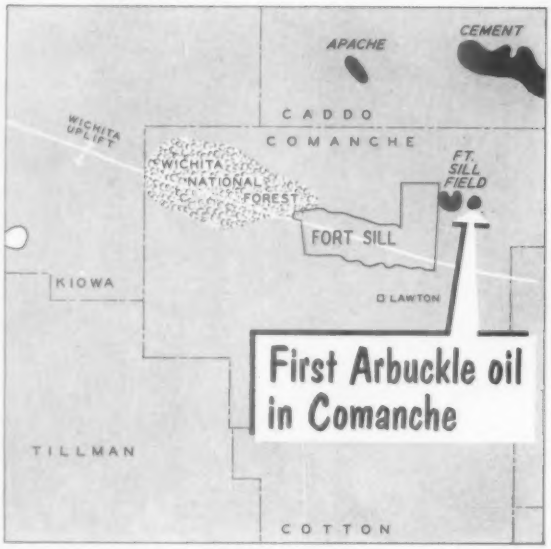
Finally, the field discovery has directed exploratory attention to the Marietta syncline, one of southern Oklahoma's few remaining virgin areas.

Acknowledgments

The authors wish to acknowledge the kind assistance of the following individuals who graciously supplied well logs and subsurface information: Jerome M. Westheimer, Ardmore, Okla.; R. M. Berry, Magnolia Petroleum Co.; Pasotex Petroleum Co.; Edwin B. and Edwin L. Cox, Dallas; R. B. Stewart, district geologist, British-American Oil Producing Co.; Quintin Little, Ardmore; G. J. Isbell, chief geologist, Cameron Oil Co.; V. A. Peterson, division geologist, Sinclair Oil & Gas Co.; J. W. Inkster, Shell Oil Co.; and W. R. Johnson, Texaco, Inc.

The senior author recognizes in particular the numerous contributions of several of his subsurface geology students.

Good Arbuckle production for Oklahoma's Comanche



FIRST Arbuckle oil was tapped last week in Oklahoma's Comanche County by Continental Oil Co.

AN IMPORTANT Arbuckle Cambro-Ordovician oil pool opened in southwestern Oklahoma last week. Continental Oil Co. found first Arbuckle production for Comanche County at its 1 Mansel, a deep test just east of the Fort Sill Military Reservation in C SE SW 14-3n-10w.

Oil flowed through 3/64-in. choke at the hourly rate of 20 bbl. Gravity is 36.3°. Perforations were at 9,160-62 ft., 9,170-72 ft., and 9,182-84 ft. Previously the well indicated Bromide Ordovician production at 7,145-70 ft. when 900 ft. of oil was recovered on drill-stem test.

This well lies on the complicated north flanks of the Wichita Mountains. This section of the state is becoming more and more attractive to deeper exploration. Production in this area is old and shallow for the most part, but in the past few years some important deep strikes have improved the outlook here tremendously. This Arbuckle find should give Comanche County's exploratory outlook a real boost.

Other western news . . . A big gasser is reported at another western Oklahoma well. Cecil Simms 1 Denby in NW SW SE 16-8n-22w, 1½ miles east of Northwest Moravia oil field in Beckham County.

The well flowed up to 30 M.M. c.f.d. from 1,315 ft. The well is being drilled by cable-tool rig. While drilling near 1,300 ft., the well blew the bit and line up the hole. Casing was set at 1,254 ft. and the hole drilled to 1,315 ft.

Texas' Upton gets second well in new field

The second well in the new McElroy-Pennsylvanian field of Upton County, West Texas, flowed 286 bbl. of oil in 24 hours on ¼-in. choke. The well is Gulf Oil Corp. 147 Crier-McElroy. It lies ½ mile west of the discovery well. Perforations are at 9,162-72 ft. Location is in Section 198, Block F, CCSD&RGNG Sur., 3 miles east of the town of Crane.

Exploration Outlook

By John C. McCaslin

Drills dig on despite disappointments in . . .

WILDCATS are whirring again in one of the country's most complex and disappointing oil provinces —Washington. More than 325 wells have been drilled in this Pacific Northwest wildcat museum, but only one ever made the commercial grade. Oilhunters don't seem to scare easily, so we will see many more wells go down in this geologic unknown.

After considerable disinterest

. . . the push for oil and gas in the Pacific Northwest is under way again. Two new wildcat locations in western Washington will be watched closely in the coming months. In Lewis County, Shell Oil Co. will go down for a look at Upper Eocene rocks in the Winlock area. Location of this important stratigraphic test is 35 miles south of Olympia. Grays Harbor County, seat of the state's only producing oil well, continues to set the drilling pace in Washington exploration. Tideland Oil & Gas Co. will drill a 6,500-ft. wildcat 11 miles north of Ocean City. This company is already drilling at another wildcat in the Long Island region of Pacific County.

Washington exploration

. . . is a story of cycles. It began at the first of the century in Snohomish County when John McManus drilled a 900-ft. hole. Oil was reported in the state even earlier than that on the west side of the Olympic Peninsula at the famous "smell muds." From this feeble beginning wildcatting reached its peak in 1930 when the opening of Rattlesnake Hills gas field fired a drilling spree that saw 27 wells completed.

. . . has little stratigraphic history behind it. Most wells drilled in the state before 1940 were put down on the basis of oil and gas seeps, previous showings, and a good bit of boldness. After the war geologic interest in the state's potential as an oil producer began to simmer a bit. Large and small companies took a more serious look at the vast complex geologic paradox. This interest culminated in the Ocean City oil discovery in 1957. The Tanner-Sunshine Mining Co. et al. 1 Medina well made 161 bbl. of oil in 20 hours on its initial production test from Miocene rocks.

The expected push for oil

. . . failed to materialize after the Ocean City discovery, but interest failed to die out completely. The mere fact that companies spend such big sums of money in Washington indicate the dismal discovery record has failed to wet exploratory zeal here.

. . . will have its troubles. Surface geology is nearly impossible in the western part of the state in particular. There are great layers of "trash" deposits above competent formations. The tremendous amount of rainfall in this highly forested section of the country creates further problems.

Even with the reliable tools of today's explorers, the wildcat scrutiny of Washington will be tough. Seismic, magnetometer, and gravity work is stymied in many places by the highly faulted section which is made even worse by the glacial interbedding and volcanic covers found nearly everywhere.

Most of the exploration in Washington will likely be on the western coastal areas, particularly in the Olympic and Grays Harbor areas. This search could well slip on down the coast into Oregon.

The lure of a virgin province

. . . will continue to attract wildcatters. Washington has large sedimentary basins with thick deposits of Pliocene and Miocene sediments, particularly in the Grays Harbor area, making this one of the most promising possible oil domains. The so-called "smell muds," a phenomenon consisting of fractured shales that give off a kerosine odor, still arouse the interest of geologists in the coastal areas as they did the Indians many years ago.

. . . is having a slow effect. Companies have always spent large sums of wildcat money in Washington as they have in all new oil provinces. Union Oil Co. of California alone reportedly has spent about $3 million in the Ocean City area. The state's complicated geology holds an upper hand, however, and while still holding great promise due to the thick marine section in the western part of the state, drilling in Washington will be a long and slow process. Everyone agrees that close and deep drilling might do the job in Washington. The three wildcats now planned or drilling in the state may well be the most important trio in the long, hard exploratory history of the Pacific Northwest.

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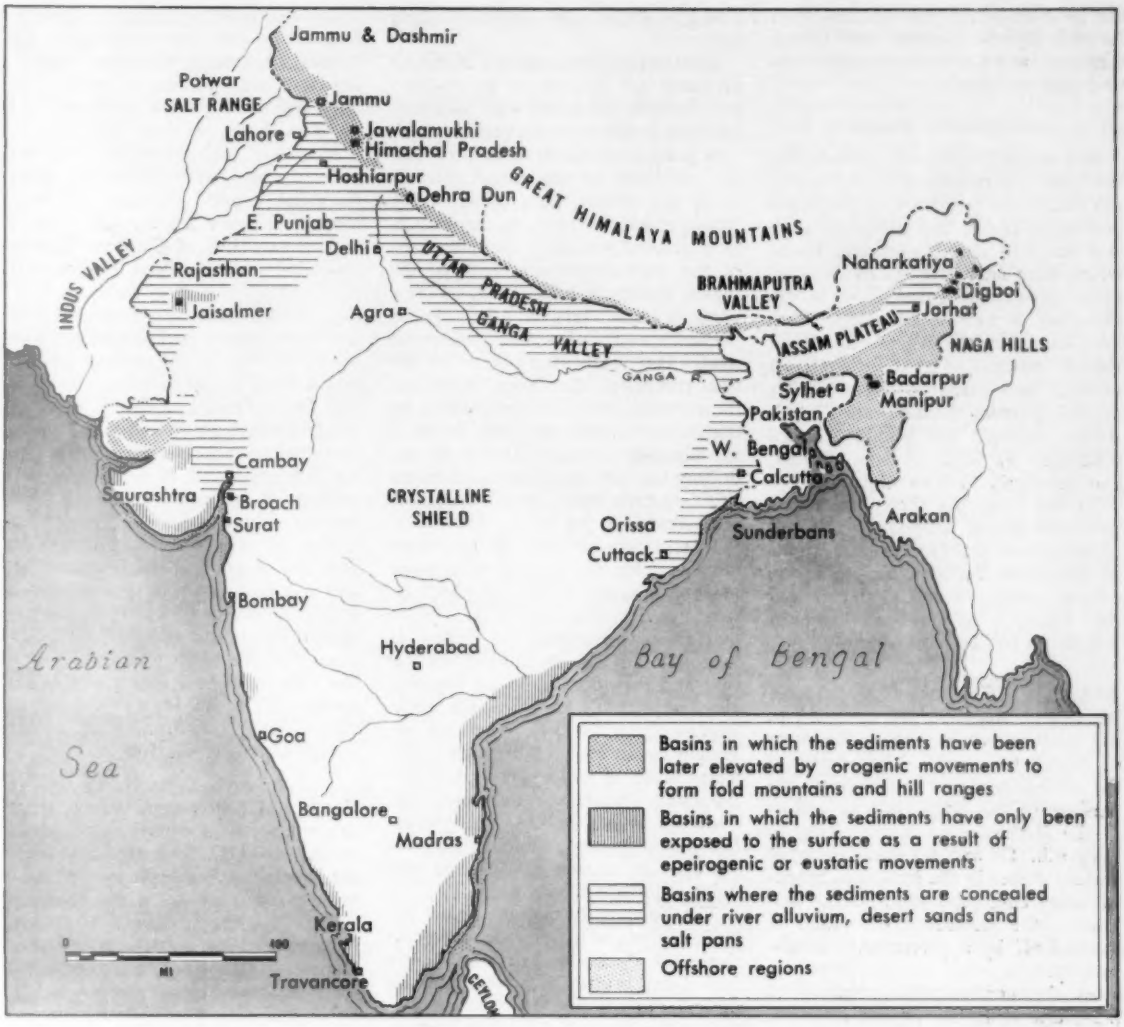


Basins around the edge of this Asian nation show features which might favor . . .

Oil prospects in India

"Sedimentary rocks of considerable thickness are restricted to the northern side of the peninsula."

BY A. M. N. GHOSH
India

THE SUBCONTINENT of India is divisible into three geographical units. One is a relic of the Gondwanaland, the ancient land mass of the Southern Hemisphere stretching from Australia to South America through India, Madagascar, South Africa, and Antarctica. The Indian relic consists of a triangular peninsula projecting into the Indian Ocean and bounded on the east and west by the Bay of Bengal and the Arabian Sea respectively. At its northern edge the peninsula is crescent-shaped and is almost parallel to the foothills zone of the Himalayas between Punjab and Assam. A severed portion of the peninsula constitutes the Assam plateau on the northeast overlooking the Brahmaputra Valley.

Another unit, conveniently referred to as the extrapeninsular region, comprises the mountainous belt of the Himalayas stretching for a distance of nearly 1,500 miles from Kashmir on the northwest to the gorge of the Brahmaputra in Assam on the northeast.

Lying between these two units is

The author is with the Oil and Natural Gas Commission, Government of India, Ministry of Steel, Mines, and Fuel. This is an abridgement of a paper presented at 1959 Fifth World Petroleum Congress.

the great Indo-Gangetic alluvial plain formed by the Indus, the Ganga (Ganges), and the Brahmaputra rivers and their tributaries.

Sedimentary Basins

Sedimentary rocks of considerable thickness are restricted to the northern side of the peninsula. In the extra-peninsular region the sediments were laid down in slowly subsiding basins which were later affected by the orogenic movements culminating in the elevation, in Middle and Upper Tertiary times, of the Alpine-Himalayan folded mountain system which brought into existence the oil fields extending from Europe and North Africa, through the Middle Eastern countries, Pakistan, Assam, Burma, and Indonesia to New Guinea.

In the peninsula there are a few restricted basins formed as a result of temporary and local transgressions of the sea on the coast such as in the deltaic regions of the Godavari and the Cauvery on the east and in Kerala on the extreme southwest.

Assam . . . The known oil fields of the Indian Republic are confined to the northeastern corner in the State of Assam (see map). They occur at the northeastern and southwestern extensions of the Naga Hills as well as in the Brahmaputra Valley lying to the north. Oil and gas shows occur at various places in the fresh and brackish water Oligocene and Miocene sediments, the boundary of which is marked off by a pronounced unconformity.

At the northeastern extremity of the Naga Hills lies Digboi oil field. The Digboi structure is about 10 miles long and nearly 1½ miles wide. The northwestern limb of the structure has been sliced off by a major thrust causing the oil-bearing sandstones to rise abruptly overlooking an alluvial plain.

There are several horizons of oil sand within the fresh-water Middle Miocene sandstones, locally known as the Tipam. The producing sands are generally within a depth of 5,000 ft. from the surface, but some of them are deeper.

In the Makum area, southeast of Digboi, the oil occurs in brackish-water Oligocene sandstones, locally known as the Barail.

The Digboi oil is supposed to have migrated into the Tipam from the underlying Barail of Oligocene age.

A small-sized oil field was also discovered at Badarpur in 1915 near Cachar at the southwestern end of the Naga Hills. At the Badarpur field production steadily declined and the field was finally abandoned in 1933. The pay zone is in Lower Miocene sediments.

Both the Digboi and the Badarpur oil fields are situated on thrust-faulted, narrow, asymmetrical anticlines trending northeast-southwest.

A portion of the Brahmaputra Valley, northeast of the Assam plateau, is of the nature of a ramp valley having originated from the subsidence, to a great depth, of a faulted block of the northeastern extension of the Indian Peninsula which was, in these parts, caught between the closing jaws of a vise aligned northeast-southwest. The southeastern limb of the vise comprises the Naga Hills and the northwestern limb represented by the Assam Himalayas. The depth of the basement is over 20,000 ft. So far, drilling has not been continued below the Oligocene strata which form the main reservoir for oil in this valley.

Information gathered by the Assam Oil Co. from the drilling of a number of wells, the deepest of which attained a depth of 13,739 ft., shows that in the Brahmaputra Valley of Upper Assam, the unconsolidated Recent and Pleistocene alluvial deposits, clay, silt, gravels, etc., reach a thickness of about 5,000 ft. They are underlain by another 5,000 ft. of fresh-water Miocene rocks overlying brackish-water Oligocene sandstones and clays. It is not known what underlies the Oligocene, although the occurrence of marine Eocene and still older sediments is not unlikely.

The Tertiary formations below the Brahmaputra alluvium are comparatively flat. Sometimes they are gently folded and broken by a large number of criss-cross faults. In contradistinction to the intensely folded and thrust-faulted sediments of the Naga Hills on the south-southeast and the Assam Himalaya on the northwest, the sedimentary formations of the Upper Assam ramp valley have escaped the effects of severe orogeny. The oil fields in the valley are situated on gently folded anticlinal structures confined within fault blocks. The oil-bearing Oligocene sandstones occur at depths ranging from 9,000 to 13,000 ft.

Cambay . . . Although gas seepages are known at a number of places within the confines of the Indian Union, so far no genuine occurrence of oil seepage has been known outside of Assam.

In September 1958, petroleum was discovered near Cambay, about 300 miles north of Bombay, as a result of deep drilling by the Oil & Natural Gas Commission. A few oil-bearing horizons have been penetrated within a depth of about 6,500 ft. in sandy layers associated with thick, dark marine shales and clays ranging in age from Paleocene to Miocene. A shallow well near Baroda in Upper Tertiary sediments yielded some gas and oil at a depth of about 500 ft.

Magnetic reconnaissance survey over an area of about 10,000 sq. miles indicated a good thickness of sediments laid down in a trough, north of the present Gulf of Cambay. Seismic reflection surveys, about 8 miles west of Cambay, indicated gentle undulation of the concealed sediments. These sediments have a thickness of approximately 7,000 ft. A reversal of dip was worked out in detail at this place and five reflecting horizons were noticed. Drilling on the structure yielded oil under considerable pressure in the reference well at more than one horizon in Miocene, Oligocene, and Eocene sediments.

The oil was formed, presumably, after the eruption of the Deccan Trap and has been more or less preserved within the source rocks. From the nature of micro and macrofossils it appears that the basin was always shallow. The drill hole near Cambay encountered Deccan Trap at a depth of about 7,000 ft., confirming the seismic interpretation within 100 ft.

Cutch . . . Adjoining Cambay region and lying to its northwest is the island of Cutch. This tract is separated from the Saurashtra Peninsula by a shallow marshy tract known as the Rann of Cutch. The Cutch mainland is mainly composed of marine Middle and Upper Jurassic and Tertiary rocks but the former are extensively intruded by dykes and sills, possibly belonging to the Deccan Trap. Trap occupies a fairly large area aligned in an east-west direction and overlies the Jurassic outcrops towards its northern boundary and underlies the Tertiaries towards the south.

The Jurassic rocks of this region, famous for their rich ammonite fauna, consist of limestones, sandstones, and dark, carbonaceous and pyritic shales. There are three large anticlinal folds aligned east-west and faulted on the northern side.

The Tertiary rocks consist of a basal laterite overlain by Eocene clays, gypsiferous shales, and nummulitic limestones.

Oligocene is represented by shales and thin sands, and Mio-Pliocene by marine shales which are partly carbonaceous, gypsiferous, and sometimes slightly bituminous.

The Tertiaries have been estimated to be about 2,500 ft. thick and are gently folded on the western and southwestern coastal areas. The real interest of Cutch lies in the Tertiary

It is estimated that a fairly large area of some 400,000 sq. miles (approximately 1,000,000 sq. km.) of sedimentary basins in India merits consideration for the exploration of oil and natural gas.

A general subdivision of this area follows:

	Sq. miles
The region of Assam (including Tripura and Manipur)	30,000
The West Bengal basin (including parts of coastal Orissa)	30,000
Punjab (including Himachal Pradesh and Jammu)	50,000
Rajasthan (Rajputana)	46,500
Cambay-Cutch	68,500
Ganga Valley	142,000
Madras Coast	17,000
Andhra Coast	9,500
Travancore Coast	6,000
Andaman and Nicobar Islands	3,000
Total	402,000

formations fringing the coastal areas on the southern side. The shallow Continental Shelf to the west also merits consideration.

Rajasthan (Rajputana) . . . Marine Jurassic rocks, resting on a boulder bed which in its turn rests on a crystalline basement, are exposed over large areas in Jaisalmer and extend as far north as the Salt Range in West Pakistan. The outcrops are, however, isolated by intervening wind-borne sands of the Rajasthan Desert and river alluvia of the Indus and its tributaries. The Rajasthan Jurassic consists of a shallow water coastal facies of alternate compact-buff, light-brown sandstones and grits. Some of the sands are rich in marine fossils similar to those in Cutch.

The Jurassic beds are overlain by fossiliferous marine Lower Cretaceous sandstones, shales, and limestones and these in turn by the Eocene beds consisting of nummulitic limestones associated with lignite-bearing sandstones and bentonitic clays.

Aeromagnetic surveys over 17,000 sq. miles in western Rajasthan have indicated a shallow depth to the basement on the eastern part. The basement rocks become progressively deeper northward and westward from Jaisalmer. In this area the depth of basement is of the order of 20,000-30,000 ft., according to the data obtained from these surveys. The nature and age of the sediments overlying the crystalline basement rocks are not known as they are concealed under thick deposits of desert sands, but it may be safely presumed that a good thickness of Tertiary and Mesozoic marine sediments exist below the sand dunes of Jaisalmer.

East Punjab . . . North of the arid tracts of Rajasthan (Rajputana) lie the fertile plains of East Punjab drained by the tributaries of the Indus. A thick mantle of river alluvium conceals the sediments consisting of Upper Tertiary fluviatile sandstones, clays, and conglomerates and possibly older sediments supported on a platform at the northern edge of the stable peninsula.

Aeromagnetic surveys indicate that although the basement rocks are generally within 5,000 ft. of the surface, in certain areas adjoining the foothills of the Outer Himalaya, the depths may be between 10,000-12,000 ft. Gravity surveys have revealed very strong regional anomalies, suggesting a fairly uneven topography of the basement.

Seismic surveys have indicated the crystalline basement to be gently sloping toward the mountain front. The overlying sediments, as could be judged from the behaviour of the reflecting horizons, have very moderate homoclinal dips, generally tilted toward the Himalayas on the east. Gentle flexures with small vertical closures seem to be present.

A deep test well is in progress on one of these closures in the plains near Hoshiarpur, a few miles to the southwest of the foothill belt. To date, Upper Tertiary fresh-water sandstones, clays, and conglomerates have been penetrated to below a depth of 10,000 ft. The Upper Tertiary formations are expected to be underlain by brackish-water and marine beds belonging to the Middle and Lower Tertiary.

Ganga Valley . . . Not much information is available regarding the subsurface geology of the vast Indo-Gangetic alluvial tract. This alluvium conceals a depression of variable depth lying immediately north of the crystalline shield of the Indian Peninsula and south of the Himalayas between Kashmir and Assam.

The Ganga Valley, occupying a portion of this vast tract, is situated on the foredeep of the Himalayas. It is comparable to the large zone of foredeeps stretching along the southern margin of the Upper Tertiary fold system of Iraq, Iran, and West Pakistan which contain many large and small oil fields. From aeromagnetic surveys over 100,000 sq. miles in the region between East Punjab on the west and Bihar on the east, it appears that the Ganga basin has an uneven basement topography. The basin is segmented into four or five sections parallel or subparallel to the Himalayan range on the north and partitioned by meridional spurs of the Gondwana massif.

In some of these sectors the basement appears to lie within comparatively shallow depths of up to about 5,000 ft. The intervening portions contain great thicknesses of sediments, ranging between 20,000 and 30,000 ft. generally accumulated in geosynclines. From available seismic data the subsurface formations appear comparatively flat with gentle homoclinal dips. Locally there are gentle rolls culminating in dome-shaped structures.

Bengal basin . . . This basin is now occupied by the delta of the Ganga (Ganges) and the Brahmaputra. It was the site of a former epicontinental sea which had made several transgressions from the south since Upper Cretaceous times. The sea was the forerunner of the Bay of Bengal and extended as far north and northeast as Assam.

The western edge of the basin is delimited by the northeastern part of the peninsula in Bihar and runs in a southerly direction, first through some of the western districts of West Bengal and later through some of the eastern districts of Orissa. Insignificant exposures of marine sediments are provided by fossiliferous Miocene limestones and clays at a few places near the western edge of the basin.

The eastern edge of the basin is dominated by the low range of Upper Tertiary hills of Tripura bordering East Pakistan. In Tripura, four major anticlines with a north-south alignment have been recognized in Upper Tertiary formations. Gas shows have been recorded at a few places.

On the northeast the Bengal basin terminates against the Tertiary foot-

"The study of the Continental Shelf of the Indian Peninsula by marine seismic methods has not commenced. Suitable regions for marine seismic surveys can . . . be indicated by available geological evidence from surface exposures of the marine rocks along the coastal areas."

hills along the southern edge of the dismembered portion of the peninsula provided by the Assam plateau. Oil and gas shows occur at many places in these foothills.

Aeromagnetic surveys over an area of 70,000 sq. miles in West Bengal, followed by geophysical ground surveys by Standard-Vacuum Oil Co., have indicated that the basin is deepest in the central and southeastern portions where the thickness of the sediments is in excess of 20,000 ft. Step-faulting has been observed to some extent. So far, sharp folding has not been noticed in any of the structures outlined by seismic prospecting.

Test drilling by Standard-Vacuum Oil Co. has revealed that the sediments in the Bengal basin range in age from Upper Cretaceous to Recent. The sedimentary beds include a good thickness of marine, estuarine, brackish-water, and near-shore continental type of sandstones, shales, and fossiliferous limestones. Both source and reservoir facies of rocks are present. The basement is composed of basic lava flows, the age of which may range from Upper Jurassic to Lower Cretaceous.

Coastal areas . . . The coastal areas on both sides of the triangular peninsula were invaded by the sea at various times since Upper Jurassic times. On the eastern side in the Coromandel coast, marine Upper Jurassic beds are associated with fresh-water beds in the Godavari Valley. On the western side, marine Cretaceous occurs in the Narmada Valley below the Deccan Trap.

The most promising of the coastal areas for oil exploration is the Cauvery basin on the Coromandel coast. The formations consist of highly fossiliferous marine Upper Cretaceous (Cenomanian-Danian) shales, sandstones, and limestones which are overlain at places by Eocene nummulitic beds. The Cretaceous sediments are faulted against the crystalline rocks of the Gondwana massif on the west and dip eastwards at low angles toward the Bay of Bengal. The beds are over 8,000 ft. thick and toward the coast to the east are concealed by Quarternary sediments.

Andaman Islands . . . The extent of the sedimentary rocks in these islands in the Bay of Bengal approximates 3,000 sq. miles, of which an area of about 2,000 sq. miles has been covered by preliminary geological mapping.

The rocks consist mainly of marine sediments of Tertiary age and some serpentines associated with bands of limestones of late Mezoic age. Lower Tertiary sandstones, grits, clays, and arenaceous foraminiferal limestones are present in the outcrops along creeks.

Mud volcanoes, in an almost straight alignment, are present on one of the islands of the Andaman group and traces of paraffinoid crude oil have been reported in the ejected fluid mud.

Geologically the Andaman Islands appear to be the continuation of the Arakan hill range of Western Burma.

Offshore region . . . At present the study of the continental shelf of the Indian Peninsula by marine seismic methods has not commenced. Suitable regions for marine seismic surveys can, however, be indicated by available geological evidence from surface exposures of the marine rocks along the coastal areas. The best of such areas for offshore investigations seems to be the Gulf of Cambay. This gulf is fairly shallow and the marine sediments found in the test well near Cambay are expected to thicken southwards.

The Rann of Cutch is another promising area as marine Tertiary and Mesozoic sediments are present in the island itself. The continental shelf on the west is shallow and has a very great extension, and it is probable that folded Tertiaries will be found below the sea bottom.

The seaboard off the Coromandel coast in Trichinopoly area is likely to contain the eastern extension of the marine Cretaceous and Tertiary rocks which are present inland. In the course of advance and retreat of the sea in the Tertiary period in this area pinchouts and stratigraphic traps may have been formed below the sea.

The continental shelf off the coast of Orissa and West Bengal is another likely area where the southern extension of the marine Cretaceous and Tertiary rocks of the Bengal basin will be found at depth.

Conclusions

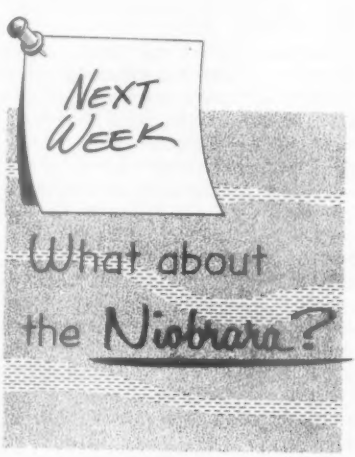
The Digboi oil field is being exploited by the Assam Oil Co. The northeastern portion of the Upper Brahmaputra Valley has produced some oil fields which are being exploited by the Oil India (Private), Ltd., a joint venture in which the government of India and the Assam Oil Co. have entered a partnership.

The exploration of the Bengal basin is undertaken by the Indo-Stanvac Petroleum Project, in which the government of India and Standard-Vacuum Oil Co. are partners.

In recent years the government of India has undertaken oil prospecting through the Oil & Natural Gas Commission. This organization has launched a program for exploring areas, some of which were left out by the oil companies.

Up-to-date methods are employed by the commission in prospecting for oil. Three deep wells have been sunk, one on an exposed structure at Jawalmukhi and two on concealed structures at Hoshiarpur and Cambay, both of which were discovered by geophysical methods.

Drilling will be undertaken on a fourth structure, which has been outlined by seismic surveys in the Brahmaputra Valley in Upper Assam. As has been mentioned earlier, a certain measure of initial success has been obtained at both the conference wells at Jawalamukhi and Cambay. The commission has plans to extend its exploration program over a wider area.



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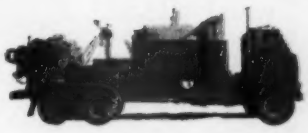

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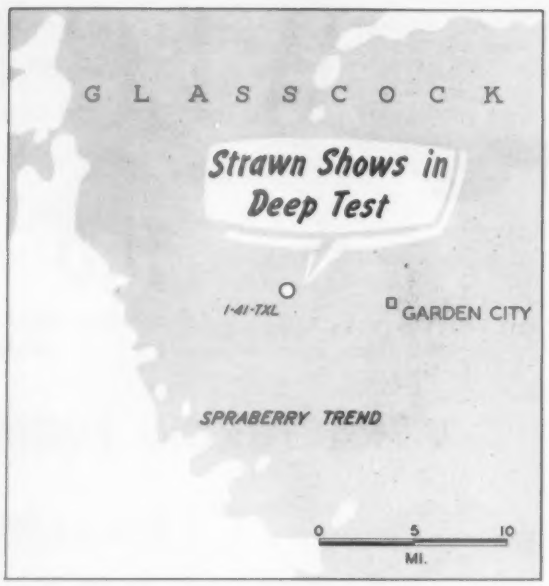
Texas deep drilling taps Spraberry trend

A DEEP exploration in central Glasscock County, West Texas, has recovered oil from the Spraberry and has had condensate shows in the Pennsylvanian Strawn.

United States Smelting, Refining & Mining Co. and TXL Oil Corp. 1-41 TXL, is an Ellenburger wildcat, 4½ miles west and slightly north of Garden City. A drill-stem test in Pennsylvanian Strawn at 10,020-10,155 ft. had a flow of gas in 5 minutes and recovered 360 ft. of gas-cut mud and 30 ft. of heavily condensate-cut mud. Flowing pressure was 170 psi. Shut-in pressure was 2,640 psi. in 30 minutes. Drilling continued toward projected depth of 11,000 ft.

Spraberry production was indicated earlier when operators recovered 30 ft. of oil and reversed out 350 ft. of oil and mud on a test at 7,339-78 ft. At 7,385-7,430 ft. operators reversed out 5 bbl. of heavily oil and gas-cut mud.

No. 1-41 TXL is 10 miles east of nearest Spraberry production in the Spraberry Trend area, and 20 miles east-southeast of Strawn production in the Azalea area of northeastern Midland County.



CENTRAL Glasscock County deep exploration has had encouraging shows in Permian and Pennsylvanian formations. Test is U. S. Smelting, Refining & Mining Co. and TXL Oil Corp. 1-41 TXL.

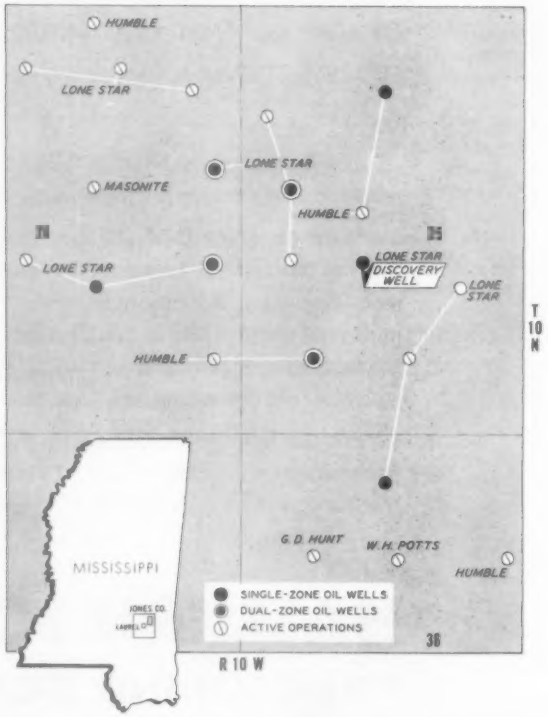
Mississippi's Bryan keeps drills busy

BRYAN FIELD, with 12 wells in various stages of completion, looms as one of Mississippi's more important deep drilling areas. Currently, it leads the state in number of active operations, passing the previously leading Little Creek field where new drilling has dropped off sharply in recent weeks.

Successful completion of these wells will boost the total for the field—now less than a year old—to 20, with no dry holes having been drilled so far. They will extend the present productive area, now slightly less than a mile long and about the same distance wide, to a length of nearly 2 miles from north to south, and slightly more than a mile wide, east to west.

The field is in the northeast corner of Jones County about 15 miles northeast of Laurel. It was opened late in September of last year by Lone Star Producing Co. and Central Oil Co. in a joint operation, their 1 Masonite Corp. Discovery well, spotted 330 ft. out of the northwest corner of the NE SW 25-10n-10w, is on the extreme eastern side of the present producing area.

Present production is from two Lower Cretaceous horizons — the Sligo, the deeper, at depths of 10,700 ft. to below 11,000 ft., and the Rodessa at depths of 10,250 to 10,300 ft.



The over-all score now is seven wells producing from the deeper Sligo horizon, and five with production from the Rodessa. This gives the equivalent of 12 wells in the field.

Four of the present eight completed wells are dually completed in both horizons. Of the other four wells, three now are producing only from the Sligo, and 1 from the Rodessa.

Lone Star continues to be the leading operator in the field with 6 of the 8 already completed wells and 6 of the 12 wells now in process of completion. It has two additional locations ready to drill.

Humble Oil & Refining Co., which came into the picture last December, now has two completed wells with three additional wells being tested. One of Humble's testing wells, its 1 Bryan Oil Unit 1-L, is the most southeasterly test for the field. Another, its 1-L Harris McFarland et ux, is the most northerly.

Other newer active participants in the development at Bryan include Masonite Corp., now testing the Rodessa pay at the field's most westerly location on the company's fee land; and G. D. Hunt, and W. H. Potts and others, each testing Sligo sand in south extension wells.

In view of the depth of the producing horizons, drilling in the field has accumulated an impressive total footage of 239,336, with the 8 completed wells accounting for 95,466 ft., and the 12 testing wells 143,870 ft.

Potential is boosted for Arizona basin

REPORTS just released on a January gas discovery in northeastern Arizona's Apache County further increase the gas potential of the Black Mesa basin area. The strike is Superior Oil Co. 14-16 Navajo in SW SW 16-41n-30e, 4 miles west of Bita Peak field and 10 miles east of East Boundary Butte field.

The gas hit had a calculated openflow potential of 12,500 M.c.f.d. from perforations at 5,063-71 ft. in lower Boundary Butte Pennsylvanian. Test flows included 1,648 M.c.f.d. on 15/64-in. choke, 4,002 M.c.f.d. on 23/64-in. choke. There was also condensate during tests.

Probe for helium begins in Arizona

In Arizona Texas American Oil Corp. of Midland has started drilling at 2 Fitzgerald, Apache County.

Primary goal of the explorer is to develop commercial discovery production of helium gas from two possible pay zones in the Coconino formation above 1,200 ft.

It is 7 miles west of the town of Navajo and 760 ft. from south and 1,120 ft. from east lines of 22-20n-25e, and 3½ miles northwest of Kerr-McGee Oil Industries, Inc., Pinta Dome helium gas pool.

The six completed wells in that area are shut in for lack of an outlet. A market for the helium-gas production from the Pinta Dome wells and others which may be completed in the Apache County region likely will be available soon.

The Kerr-McGee wells are credited with having the highest percentage of helium concentration of any so far drilled.

The hole will be drilled with cable tools. Helium gas is expected in two possible pay zones above 1,200 ft. The first is at approximately 720-760 ft. and the second is between 1,050-1,250 ft.

It is planned that at least one 3,500-ft. wildcat will be drilled on the block during the next 18 months, to explore possible oil and gas formations between 1,200 and 3,500 ft.

Good shows noted at Ontario well

In Canada, Imperial Oil has announced that a development well presently drilling in the Colchester area of Essex County in Southwestern Ontario has encountered an encouraging showing of oil.

The well is a followup to an oil discovery made last April and is the fourth to be drilled in the area by the company in partnership with Har-

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Imperial said the source of the oil appears to be a porous zone 135 ft. below the top of the Trenton formation and at a depth of 2,228 ft. This is approximately 70 ft. below the zone in the Trenton formation in which oil was first found.

The well, known as Imperial Harvest Submarine 4-79-1 Colchester South, is located 2,000 ft. north and 2,000 ft. west of the discovery well. Two other followup wells have been drilled in the area—one with modest results and the other suspended—and a fifth is currently drilling.

New gas field for California's Glenn County

The summer boom in drilling in California's gas provinces was credited with another new field discovery, this one in the Hamilton City area of Glenn County. General Petroleum Corp. found the new field with a wildcat located almost midway between the Ord Bend gas field and the South Dome gas field.

It is about 10 miles from each in the extreme northern limits of the state's gas activity. The new discovery, 54-10 Moda Unit, is only a little more than ½ mile northeast of a 4,198-ft. dry hole drilled by Humble Oil & Refining Co. 6 years ago.

General Petroleum completed the test in a shallow sand at 1,710-35 ft. flowing 4,400 M.c.f.d. through a 32/64-in. choke. The drill site is in NW SE 10-22n-2w near the Glenn-Tehama county lines.

Gosford area extended northward in California

The 15-year-old West Gosford area of Gosford field was extended northeast of production by a test drilled by Union Oil Co. of California in NE NE 22-30s-26e. The Union well, 81-22 KCL, was completed in an interval at 7,754-70 ft. for 139 bbl. daily of 1% cut crude.

The well is updip from a couple producers drilled and since abandoned by Tidewater Oil Co. back in 1944-45. The test was taken to 10,170 ft. before being plugged back to 7,971 ft. for the completion.

River Island gets new pool discovery

In California, the Walnut Grove area of River Island field, Sacramento County, yielded a new gas-pool discovery to Texaco, Inc. Texaco moved into SW NW 1-4n-4e to find a gas zone at 2,918-28 ft. in a 5,000-ft. test. Initially, it flowed 83 M.c.f.d. from the Nortonville formation.

California's Gaviota has new field find

A new shallow-zone field discovery was made in the onshore area at Gaviota in Santa Barbara County by Martin Bertagnole. The well, 1 Teapot-Fox, was selectively perforated in a number of intervals between 2,200 and 2,945 ft. After sand-fracturing five intervals, it was put on production, pumping 20 bbl. daily of 18°-gravity crude cutting 12%.

Stenderup area gets another extension

Kern County's Mountain View field in California continued to turn up interesting tests with a Union Oil Co. of California extension north of the Stenderup area making the list. The Union well, 64-16 Union-Signal-Jewett, was completed in the Houchin zone at 7,075-7,125 ft. and 7,134-46 ft., and 7,262-70. Initial production was 48 bbl. daily of 33.6°-gravity crude. This well is located ¼ mile north of Union's nearest well in the in the play.

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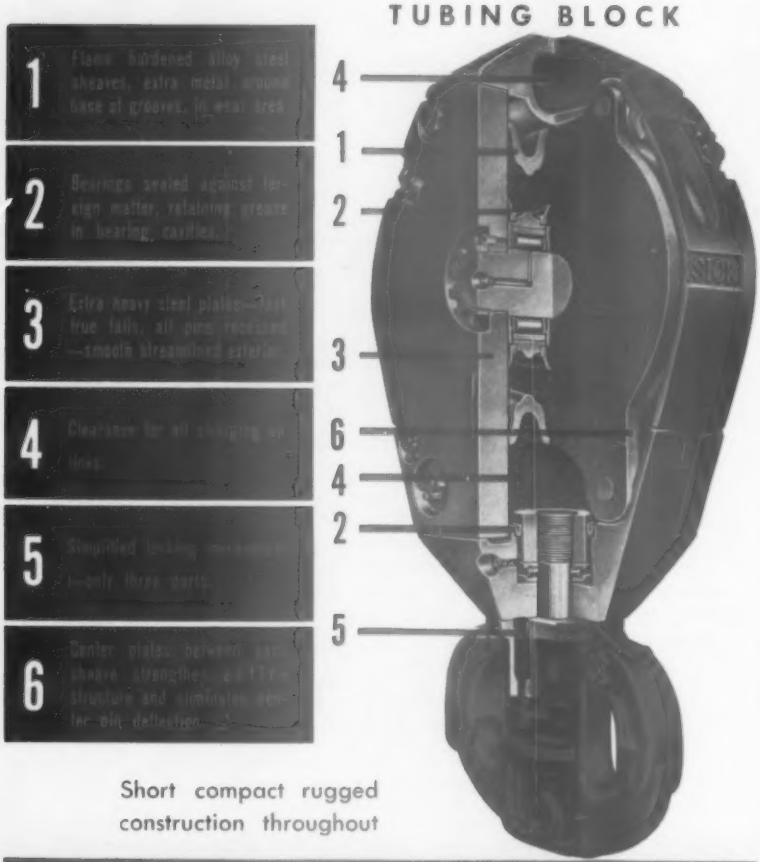

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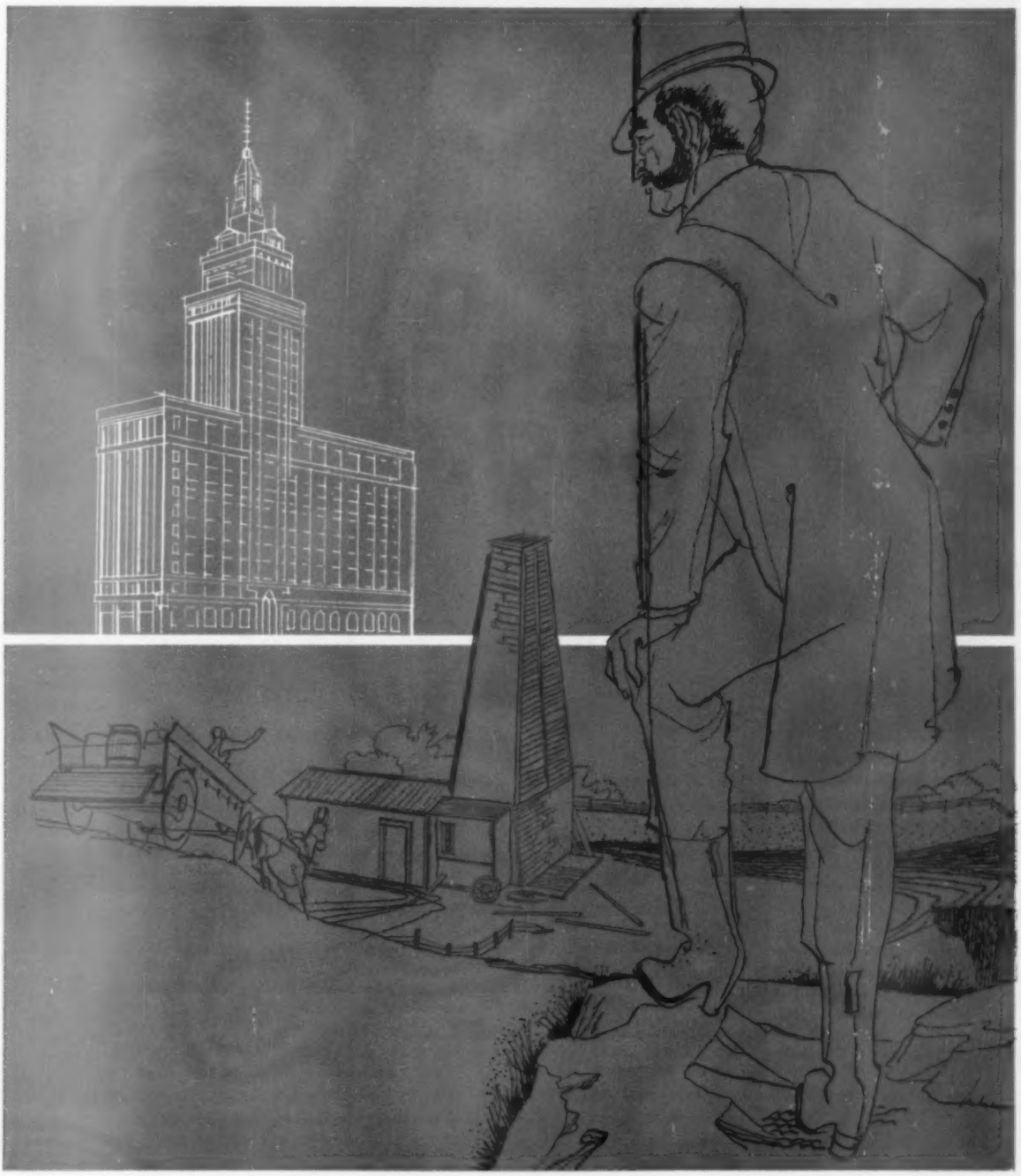

Illinois, Indiana keep drills going

A ROUNDUP of Illinois basin developments shows discoveries in Clay, Jefferson, and Hamilton counties in Illinois; Indiana strikes were in Perry, Warrick, and Scott counties.

Illinois . . . In Clay County, 8 miles north of Louisville, V.S.&S. Drilling Co. 1 Ralph Van Dyke, SE SE SE 3-5n-6e, is an Aux Vases discovery. Recovery on test at 2,702-09 ft. was 1,800 ft. of gas, 190 ft. clean oil, 20 ft. mud-mixed oil, with no water. The well is 1½ miles from production.

In Jefferson County, 5 miles northeast of Mount Vernon, F. L. Strickland - Earnest Johnson, SW SW SW 6-2s-4e, made 112 bbl. of oil per day on pump, natural, from McClosky lime at 2,880-87 ft.

In Hamilton County, 6 miles west of Norris City, Calvin Oil Co. 1 Hunt-Benefiel Unit, NW NE NW 21-6s-7e, is swabbing and flowing 35 bbl. of oil per hour from Aux Vases at 3,072-90 ft. This well is a ½-mile extension to production.

Indiana . . . There is a new basal Golconda discovery prospect for Perry County at Milt Yunker & Associates 1 Hubert Jones in SE SE NW 26-4s-3w. The well, 1 mile east of Bristow, is swab testing at 252-59 ft. It flowed 3 bbl. per hour, then bailed 7 bbl. hourly.

In Warrick County, Don P. Moroney and J. C. Westfall, Jr., set casing for tests in the Cypress sand at 1,224-46 ft. at the 1 Russell O. Tennyson in SW NW NE 22-5s-7w, 4 miles east of Boonville and 5 miles from production. The well got 300 ft. of oil-mixed mud on test at 1,203-42 ft.

There may be a rank wildcat discovery for Scott County, Indiana. Edwin Lyskowinski 1 Arthur F. Seavers, NW NW SE 7-4n-7e, near the town of Scottsburg, flowed 15 bbl. of oil per hour from Corniferous at 92 ft. Total depth is only 115 ft. This remote wildcat discovery prospect is on the western flanks of the Cincinnati Arch in nonproductive territory.

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Good find picked up in Las Animas play

THE NORTHEASTERN Las Animas arch play picked up another good Pennsylvanian oil discovery last week.

The newest addition to the growing northwestern Kansas-southern Nebraska spree is Skelly Oil Co. 1 Meyer in SE SE NW 20-1s-32w, Rawlins County.

This Lansing-Kansas City discovery pumped 258 bbl. of oil per day from perforations at 4,061-70 ft. The well opens Wilhelm field. Location is 6 miles south of growing Reiher field in Hitchcock County, Nebraska. Skelly is setting pipe at the Wicke in SE SE SE 17-1s-32w, the intended confirmation to this new field opener.

Kansas may get new pool

Kansas' Hodgeman County may have a new Mississippian oil pool. Tennessee Gas Transmission Co. 1 Novotny, SW SE NW 17-22s-23w, 4 miles north of Jetmore and 2 miles northeast of Jetmore field, got 4,002 ft. of oil on drill-stem test at 4,634-59 ft.

Drilling set for Kentucky's Morgan

In Morgan County and located on Stacy Fork, Sun Oil Co. has made location for a wildcat test, 1 J. D. Haney.

The well will probably probe Corniferous and Big Six (Silurian) sediments expected at approximately 1,900 ft. Test will be drilled with cable tools.

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Michigan has new Salina gas prospect

In Michigan Carter Oil Co. has a new Michigan Salina dolomite gas pool prospect at 1 Adler, NW SE SE 34-5n-15w, Holland Township, Ottawa County, showing gas pay in two different sections. The A-2 logged at 2,623 ft. and had 24 ft. dolomite.

Drill-stem run at 2,612-58 ft. had ungaged gas flow in 15 minutes, estimated up to 3 M.M.c.f.d. A-1, logged at 2,781 ft., gaged 1,540 M.c.f.d. on drill-stem from 2,774-97 ft.

Carter's wildcat is in the old 1,600-ft. Traverse Fillmore oil field, and located 10 miles northwest of Lloyd C. Green 1 Reimink, NE NW NW 21-3n-14w, Heath Township, Allegan County, wildcat prospect in A-2 Salina. Green's test had estimated 4,000 M.c.f.d. and spray of oil after sand fracture at 2,512-17 ft. Carter is northwest of the Overisel gas-storage field (Salina A-2) and Green is 4 miles southwest of Overisel.

Two other old Traverse pools in the same general area have been developed for Salina gas or oil or both, Dorr and Salem.

● Another gas prospect was reported at Buck and Basin 1 McClenathen, NE NE NW 18-8s-4e, Lenawee County. Wildcat logged Detroit River section at 610 ft. and gaged gas of 1,550 M.c.f.d. from 838-47 ft. with trace of water.

Scipio drilling finally pays off

THE FIRST significant development in months of exploration southeast of the Scipio Trenton oil pool paid off 5 miles out with McClure & Covey 1 Van Wert, SE SE SE 8-6s-2w, Dams Township, Hillsdale County, following gas-oil on drill stem at 3,921 ft.

Outpost logged Trenton at 3,470 ft. or 20 ft. lower than McClure 1 Daniels, ½ mile away, and topped Black River section at 3,820 ft. Test had drilling break at 3,819-21 ft., where on drill-stem test it had gas to surface in 6 minutes and flowed oil to pits in 31 minutes.

Wildcat is on the same "ruler line" trend that has produced Pulaski and Albion pools northwest of Scipio. If an extension of Scipio, it would add as much length as has been proven in the developed field in 2½ years of drilling.

Oklahoma gets big wildcat

A WILDCAT discovery in Muskogee County, eastern Oklahoma, may be the biggest well ever completed in that county. M. B. Rudman et al. drilled the 4-B Howard Brothers in the SE NE SW 12-13n-15e.

Flow was 66 bbl. of oil the first hour through a 10/64-in. choke from perforations in the Dutcher formation at 1,932-42 ft. After 2 weeks of steady production, the well flowed 138 bbl. of clean oil with no water on ⅛-in. choke with a tubing flowing pressure of 450 psi. on a 24-hour test. As a result of this well, drilling and leasing in the area has increased.

New Mexico opens new Seven Rivers production

New Seven Rivers production was opened in Lea County, southeastern New Mexico last week at William A. and Edward R. Hudson's 1 Matlock in 4-20s-34e, 4½ miles southwest of Pearl-Queen field.

The well pumped 60 bbl. of oil daily on potential test. Gravity is 30°. Open hole section was at 3,615-30 ft.

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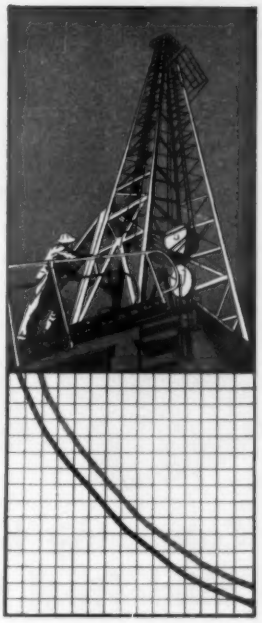

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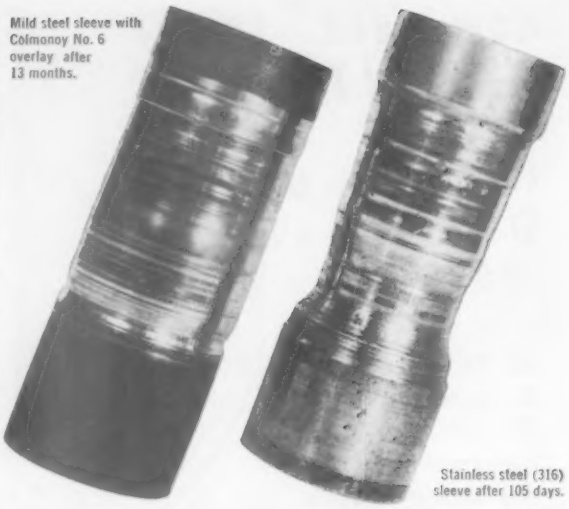
Mild steel sleeve with Colmonoy No. 6 overlay after 13 months.

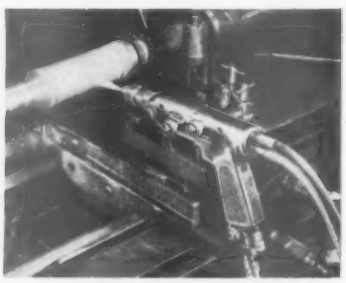


Stainless steel (316) sleeve after 105 days.

Colmonoy Hard-Surfaced Mild Steel Pump Sleeve Lasts Longer Than Stainless Steel Sleeve

Here's dramatic evidence of how Colmonoy hard-surfacing alloys can lower maintenance costs. Both pump sleeves (above) served in a Desalta charge pump, moving crude oil. The one at the right, made of 316 stainless steel, was photographed after 105 days in service (involving eight packing changes). The other one, made of mild steel with a sprayed overlay of Colmonoy No. 6 alloy, served over three times as long (with just one repacking), yet suffered much less wear.

Colmonoy No. 6 is a wear-resistant nickel-base alloy incorporating chromium borides and carbides. The powdered alloy is sprayed on with the Colmonoy Spraywelder, as shown. The smooth sprayed overlay is then fused to the base metal with an oxy-acetylene flame to form a solid, non-porous, wear-resistant overlay.



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Montana's Richey comes to life

ONE OF the oldest Williston basin fields, Montana's Richey, after several years of sporadic development plays, is on the march again.

This year's stepout drilling has pushed the field's limits more than a mile southwest of previous production in the big field. Operators doing this expansion drilling are Texota Oil Co., Ambassador Oil Co., and Great Northern Drilling Co. The push began last year, but got into full gear this year. The results have been highly successful.

It all began at Texota's 1 Berry-A in SE NE NE 26-23n-49e. That well flowed 80 bbl. per day on 14/64-in. choke. Then came the 2 Berry in SW NE 26-23n-49e. It flowed 624 bbl. of oil per day on 16/64-in. choke, sparking a brisk search. Then the 1 Schock in NE NE SW 26-23n-49e was completed for 1,060 bbl. of oil daily on 28/64-in. choke, and the 2 Schock in NE SW SW 26-23n-49e for 700 bbl. daily on 16/64-in. choke. All of the wells continue to flow except the 1-A Berry which was recently put on pump.

Current drilling . . . An all-important well currently going is the 1 Jensen in NE NE NE 34-23n-49e. Good recoveries were reported on drill-stem tests.

Plans for future development work have not been released as yet, but the field work will continue. Oil is trucked out of the field to East Poplar for pipeline.

History . . . Richey was opened in November 1951 at Shell Oil Co. 11-9 Northern Pacific Railway in SE NW NW 19-23n-50e. Total depth was 10,518 ft. Initial potential was 1,656 bbl. of oil per day and 408 bbl. water per day. Pay zone is Charles Mississippian. Location is in Dawson and McCone counties on the western side of the Williston basin. There are five separate pay zones in the Charles Mission Canyon.

Oklahoma gets new Harper dual completion

Another dual completion was added to northwestern Oklahoma's North Buffalo field in Harper County. The new well is Sinclair Oil & Gas Co. 1 Robert R. Rohrer in C SW NE 6-28n-22w.

The well flowed 165 bbl. of oil per day on 24/64-in. choke from 5,218-32 ft. in the Kansas City Pennsylvanian; from Morrow Pennsylvanian sand at 5,662-64 ft. the well flowed 6,352 M.c.f.d. through 28/64-in. choke with 12 bbl. condensate in 18 hours.

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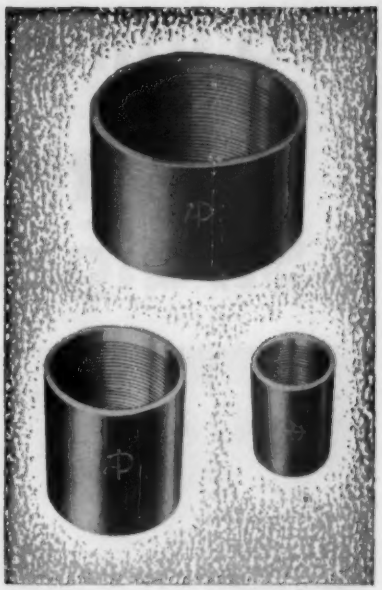

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Ohio's Ashtabula continues success

FURTHER TESTS in the gas play in Ashtabula County in northeastern Ohio continue to be successful as two more completions are reported in that area.

Summit Div. 1 W. W. Cole, Section 22, northeast Monroe Township, had the Clinton at 3,104-07 ft. with 600 M.c.f. natural and 2,234 M.c.f. with rock pressure of 980 psi. after fracture.

Belden & Blake 1 F. Bemisderfer, Section 1, southeast Kingsville Township, had the Clinton at 3,000-25 ft. with 93 M.c.f. natural and 300 M.c.f. with rock pressure of 975 psi. after fracture.

Deep tests . . . In Hinckley Township, Medina County, Ohio Fuel Gas Co., East Ohio Gas Co. and Wiser Oil Co. have staked an offset on Resa Hier, Lot 70, about ½ mile southeast of their 1 F. Smith, Lot 69 (OGJ, Feb. 16, 1959) to continue tests of this pay section for field development possibilities.

In Granger Township, Medina County, the same operators are in process of abandoning their test on 1 M. E. Warner, Lot 42, after drilling to a total depth of 6,731 ft. No significant gas or oil flows were evidenced by drill-stem tests at 5,919-50 ft., 5,975-6,020 ft. and 6,494-6,730 ft.

Panhandle map is second in series

SECOND in a series of geological pay-formation maps covering the five-state Panhandle area of Texas, Oklahoma, Kansas, Colorado, and New Mexico has been published by the Panhandle Oil Explorer, Box 3193, Amarillo.

Latest map covers the Oklahoma Panhandle counties if Cimarron, Texas, and Beaver, and shows by coding symbols the pay zone in every well and field in this 1,000-sq.-mile area.

Map is drawn to scale of 1 in. to 8,000 ft., and is 120 in. long by 27 in. wide. Each section, township, and range is shown, along with true position of wells and fields. A stratigraphic section defining relationships of area rock units is printed as part of the map.

Issued as a blueline print from a film base, the new map is suitable for coloring and for wall mounting in one or two parts. Price is $25 on paper, $35 on cloth.

First map of the series covered the northeast Texas Panhandle counties of Hansford, Ochiltree, Lipscomb, Hutchinson, Roberts, and Hemphill. Issued early this year, it has been completely revised and updated, and will be updated regularly at semi-annual intervals.

Oil shows in Woodbine at Texas wildcat

A wildcat in southeastern Freestone County, East Texas, reported 12 ft. of Woodbine sand having oil shows. Operators were running casing to bottom to make production tests.

The salt-dome prospect is Whiffen Estate, Inc. 1 Daniel Memorial Orphanage, on a 320-tract in Simon Sanchez Survey, A-30. Operators drilled to 4,791 ft. and were running pipe to bottom on the basis of electrical surveys which indicated 12 ft. of sand showing oil.

The prospect is on the flank of Butler salt dome, 2 miles southeast of Butler townsite. It is in an area where four failures were drilled last year by W. C. Perryman and George J. Greer and Associates. Nearest of the dry holes is 4 Daniel Memorial Orphanage, immediately west of the current test. The dry hole had approximately 15 ft. of Woodbine sand with slight shows.

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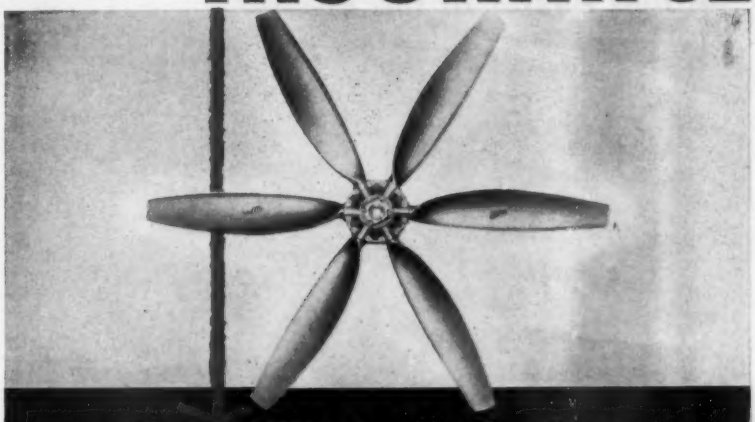

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Discovery wells

ARKANSAS

Franklin County: Arkansas Western Gas Co. 2 Patrick Estate, 20-11n-26w, 2½ miles northeast of Watalula. IP 960 M.c.f.d., estimated open flow, shut-in pressure 410 psi., perf., 1,776-1,811 ft., Atoka, and 2,500 M.c.f.d., estimated open flow, shut-in TP 526 psi., perf. 2,018-23 ft., Atoka. TD 2,884 ft. New field.

COLORADO

Weld County: Clyde G. Kissinger 1 Moyer, NE NW 33-12n-56w. IP 2,500 M.c.f.d., "D" sand discovery, new field. TD 6,479 ft. "J" sand.

Texota Oil Co. 1 Limbeck-Betterton, C NE NE 28-12n-57w. IP 4,050 M.c.f.d., "D" sand discovery, new field, TD 6,691 ft. Skull Creek.

SOUTH LOUISIANA

Cameron Parish: Hope Natural Gas Co. 1 Miami Corp., 35-14s-4w, IP 84 BOPD and 5,032 M.c.f.d., 20/64-in., 49°, TP 3,800 psi., perf. 11,264-71 ft. TD 12,505 ft. Confirmation well and east extension Go Around Bayou field.

St. Landry Parish: Olin Oil & Gas Co. 1 Zerinque, 1-7s-5e, 3 miles south of Port Barre field. IP 156 BOPD, 1,918 M.c.f.d., 12/64-in., 53.5°, TP 1,800 psi., perf. 11,022-42 ft. TD 12,706 ft. New-field discovery.

St. Mary Parish: Union Oil & Gas Corp. of Louisiana 2 State Lease 2682, 1,316 M.c.f.d., 33 BOPD, 10/64-in., TP 4,800 psi., perf. 12,970-76 ft. TD 16,452 ft. New pay in East Lake Sand field.

MICHIGAN

Mason County: Sylvania Development Co. 2 Young, SE NW SW 9-17n-15w, Logan Twp. Rework abandoned hole, IP 1 M.M.c.f.d. after acid and sand fracture. Filer sand 3,263 ft. pay 3,265-90 ft. TD 3,318 ft. New gas pool.

MISSISSIPPI

Adams County: Biglane, Laub & Eagle 1 Norman Breaux, SW SE 12-4n-4w. IPP & F 111 BOPD, 10/64-in., 40°, TP 190 psi., perf. 6,953½-54½ ft., Wilcox. TD 7,213 ft. Elev. 53 ft., Wilcox 4,942 ft., Breaux sand 6,944 ft. Discovery well Southeast Fairview field.

MONTANA

Rosebud County: L. L. Tuck-Will L. Lewis, Jr. 1-B Kincheloe, C SW SW 18-11n-32e. IPP 230 BOPD, Tyler discovery, new field. TD 4,901 ft. Otter.

NORTHWEST NEW MEXICO

Rio Arriba County: El Paso 109 San Juan Unit 28-7, SE SW 18-27n-7w. IP 1,562 M.c.f.d., Mesaverde; IP 1,087 M.c.f.d., Dakota discovery, new pool. TD 7,525 ft.

San Juan County: El Paso 15 Florence "D," SE SE 17-27n-8w. IP 2,728 M.c.f.d., Pictured Cliffs discovery, new pool.

NORTH TEXAS

Archer County: 4-B Trust 1 Andrews "D," G. C. Farley Sur., A-129, 4 miles southeast of Anarene. IP 192 BOPD, 6/64-in. choke, TP 890 psi., 42°, GOR 975:1, Mississippian 5,154-59 ft. TD 5,163 ft.

Clay County: Tex-Mem Oil Co. 1 R. H. Peterson, T. F. Johnson Sur., ½ mile southwest of Shannon. IP 134 BOPD, 16/64-in. choke, TP 250 psi., 44°, GOR 750:1, Caddo 5,423-33 ft. TD 5,503 ft.

Knox County: Bill Lisle 2 G. W. Weber, Sec. 10, Blk. 2, D&W Sur., 2 miles north of Goree. IPP 51 BOPD, 37°, GOR 300:1, pay 1,806-13 ft. TD 1,933 ft.

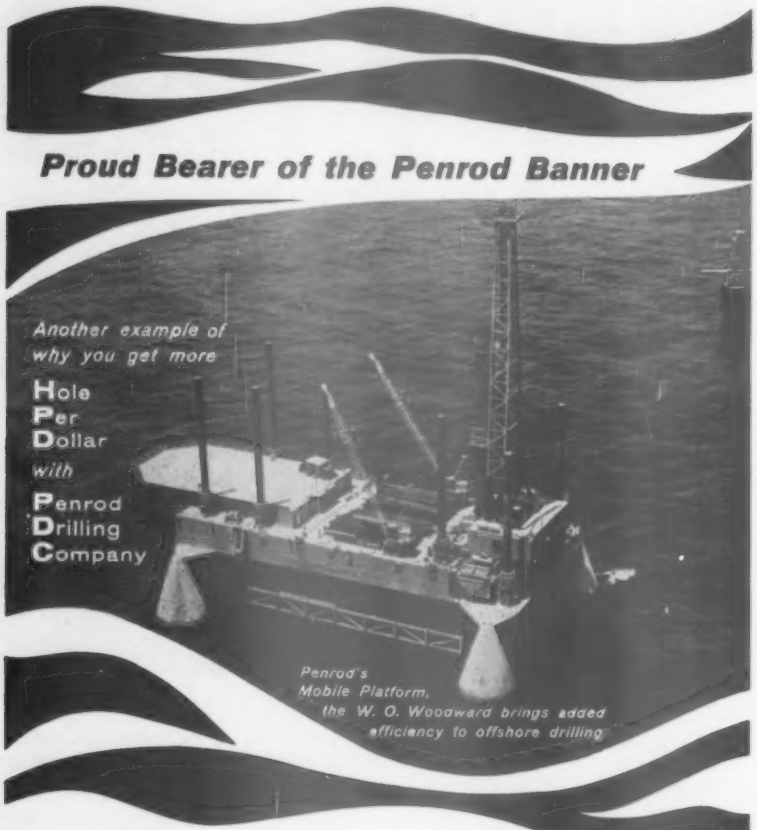
SOUTHWEST TEXAS

Duval County: Edwin L. Cox and Louis Haring 1 Gilberto Garza, Sec. 17, C. Maldonado Sur., A-672, 8 miles northwest of San Diego. AOF 6,500 M.c.f.d., dry gas, shut-in TP 546 psi., perf. 1,638-45 ft., Frio. TD 5,038 ft. New field.

Humble Oil & Refining Co. 65-A Kohler, Sec. 400, N. B. Gussett Sur., A-1204, 18 miles southwest of Freer. AOF 1,020 M.c.f.d., dry gas, shut-in TP 1,790 psi., perf. 5,343-55 ft., Queen City. TD 6,010 ft. Old dry hole deepened from 3,975 ft. Opens new reservoir in Kohler area.

C. C. Winn 1 Lelia C. Peters, Sec. 36, T. A. Cavitt Sur., A-1703, 15 miles southwest of Freer. IP 11 BOPD (net), 4% water, 12.64-in., 22°, GOR 1,600 cu. ft. per barrel, TP 75 psi., perf. 1,894-98 ft., Dougherty sand. TD 6,017 ft. New reservoir in North Peters area.

San Patricio County: Jake L. Hamon 1-B Hart, Block 3, Border, McCampbell & French Subd., Sacarias Villareal Sur., A-34, 4 miles southeast of San Patricio. IP 145 BOPD, 10/64-in., 40°, GOR 980 cu ft. per bbl., TP 900 psi., perf. 6,817-23 ft., and 132 BOPD, 10/64-in., 33.5°, GOR 853 cu. ft. per bbl., 510 psi., perf. 5,007-15 ft. TD 7,296 ft. New pays in East Riverside field.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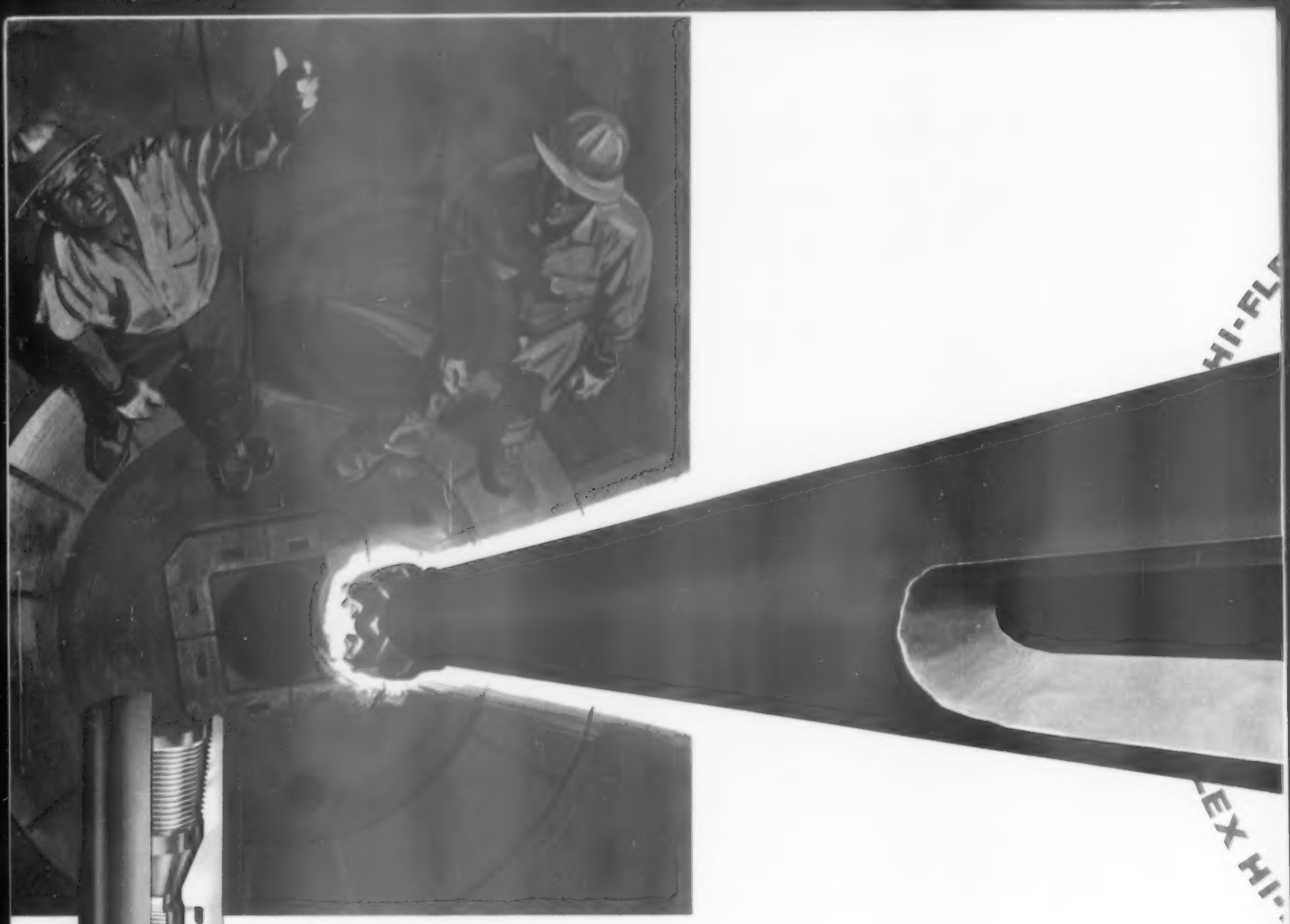

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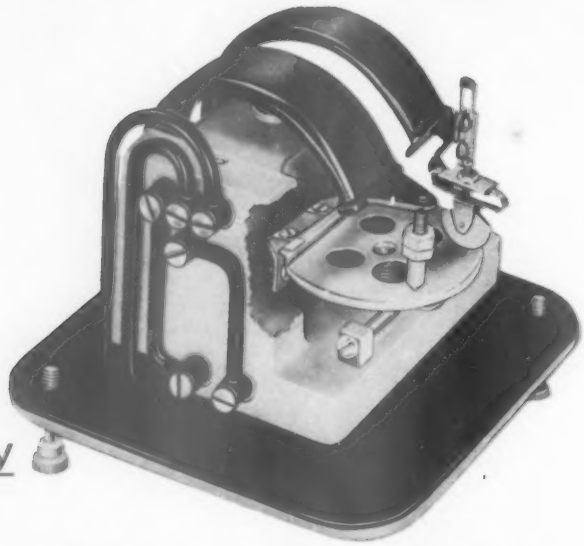

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Refiner's Job: Battle Costs

• Tate of Phillips says his life has been one long war on expenses. His discovery: Somehow you manage to cut.

HE wasn't around when Phillips Petroleum Co.'s refining department was born, but C. C. Tate joined the company when that department was still a toddler.

Ever since, Tate says, his life has been constant warfare against rising costs.

Tate, now vice president in charge of refining, joined Phillips in 1932 as an engineer at Bartlesville, Okla. He was transferred 2 years later to the company's first refinery near Borger, Tex.

Phillips had purchased this plant from Alamo Refining Co. in 1927, the same year Tate was graduated from Kansas State University.

Since Phillips had also acquired its Okmulgee, Okla., and Kansas City, Kans., refineries in 1930, the company had three refineries when Tate tossed his hat into the Phillips 66 ring. In the succeeding 27 years, he has seen the company's refining capacity grow in amazing strides. At the end of 1958, Phillips had a daily capacity of 266,500 bbl. of crude at its six refineries, a 60% increase in just the past 10 years.

Today, the company's Sweeny, Tex., refinery alone has a capacity 30% larger than the total of the company's three refineries of 15 years ago. The Sweeny refinery was acquired in 1947, as were the Woods Cross, Utah, and Great Falls, Mont., refineries.

Moves west . . . Born in Siloam Springs, Ark., in 1904, Tate was transplanted to the wide open spaces at the base of the Texas Panhandle where he was graduated from Lockney high school.

When he was graduated from Kansas State in 1927, he took with him a bachelor of science degree in electrical and mechanical engineering. Before he decided to cast his lot with Phillips, Tate spent 5 years with two other companies.

Two and a half years after Tate transferred from Bartlesville to the refinery at Borger, he was made assistant mechanical superintendent of the refinery, and a month later was promoted to night superintendent. He moved to the Okmulgee refinery in 1939 as mechanical superintendent, but was transferred back to the much larger Borger refinery as mechanical superintendent the next year.

Tate shuttled back to Okmulgee again in 1943, with a promotion to refinery superintendent. Six months later he was appointed assistant manager of the refining department in Bartlesville, where he had started as an engineer less than 12 years before.

C. C. Tate
. . . Phillips' refining boss.

Mexican interlude . . . Tate was destined to pack all of his suitcases and move again, however.

In February 1945, he was named special representative for Phillips during the construction and initial operation of the pipeline, natural gasoline extraction plant, and refining facilities for Petroleos Mexicanos (Pemex). The U. S. Government, which was supplying critical materials for these installations, had selected Phillips to act as technical supervisor on the Pemex project.

Tate spent 3½ years south of the border before returning to his position as assistant manager of refining in August 1948. A year later, he was promoted to manager of the department. When W. W. Keeler, vice president, refining, was advanced in 1951 to the executive staff where he is now executive vice president, Tate became head of the refining department. He was elected a vice president in April 1959.

Battle with costs . . . When asked what is the biggest problem in refining today, Tate answered:

"Making a refinery show a reasonable profit."

"The problem lies in the constantly increasing costs entailed in refining a barrel of crude oil, while the prices we charge for the products refined from that crude do not increase proportionately," Tate explained.

"Most people do not realize that the gasoline which can be purchased at our service stations today is comparable in performance to fighter-grade aviation gasoline produced during World War II. The additional processing to make this quality gasoline costs money that has not been reflected in the selling price.

"A refiner is faced with paying higher and higher prices for pipe, machinery, labor, and all of the other materials and services necessary to operate a refinery. The only solution we can see, without raising the prices for our products considerably, is to keep cutting expenses at every turn," he said.

"I have been in refining for 27 years, and it has always seemed that our plants have been operating as efficiently as possible," Tate said, "But, as it turns out, we continue to find ways to operate them still more efficiently, attempting to offset the increasing costs of quality improvement, materials, and labor. I still think it is our biggest headache, and it looks like it will continue as such."

Tate is a member of the general committee of the American Petroleum Institute's division of refining and the API's smoke and fumes committee. He is also a vice president, director, and member of the executive committee of the Western Petroleum Refiners Association.

●

J. F. Hunt, area reservoir engineer for Shell Oil Co. at New Orleans, has been transferred to Houston. Hunt joined Shell in 1938. He has served the company in Centralia, Ill., Wichita Falls, Tulsa, and Oklahoma City.

Robert K. Dimmitt, manager of development engineering for Monsanto Chemical Co.'s plastics division at Springfield, Mass., has been appointed assistant director of engineering there. **Alfred W. Andrews,** assistant director of the plastics division, has been assigned responsibility for the development, planning, and plastics engineering groups.

Personals

A. J. Inderrieden has been transferred from Fort Worth to Lubbock as district engineer for Pan American Petroleum Corp. He succeeds Gus Athanas who is being transferred to Canada.

R. W. Wire last week resigned as president of Loffland Brothers Co., a post he had held since January 1, 1948. Wire's resignation followed announcement of a reorganization in the world's biggest contract drilling company. He said he would not announce any plans for several months. **Thomas W. Wheeler,** vice president for contracting, was made executive vice president in the principal organization change. Loffland also gave division

R. W. WIRE

T. W. WHEELER

status to four U. S. districts and named **Rex Parks, Henry O. Heckert, J. Warren Petty,** and **William C. Walker** division managers. Loffland also appointed **Marshall W. Cone** general manager and **Paul L. Waid** superintendent of operations of Loffland Brothers Co. of Canada. Cone and the U. S. division managers will report to Wheeler. **William J. Weaver,** secretary-treasurer, was given the additional job of manager of administrative services and will be in charge of insurance, personnel, purchasing, accounting, and traffic activities. In other changes **R. L. Nicholas,** contract representative, was promoted to Rocky Mountain division contract manager; **L. A. Pyeatt** was promoted to division contract manager in Fort Worth; and **Glenn F. Miller** was promoted to assistant superintendent of the southern division. **Dorris Ballew** is chairman of the board of Loffland Brothers.

Dr. W. Paul Moeller has joined AviSun Corp. as special projects manager. AviSun is a jointly owned company of American Viscose Corp. and Sun Oil Co. formed to produce and market polypropylene polymer, film, and fiber. Moeller had been with Celanese Corp. of America 21 years and before leaving to join AviSun was sales manager of the plastics division.

Chester B. Waterman, formerly senior petroleum engineer with Sohio Petroleum Co. at Russell, Kans., now is a consulting petroleum engineer in Parkersburg, W. Va.

R. A. Pratt, with Shell companies 26 years, has been made administrative superintendent of Shell Oil Co.'s Norco, La., refinery. He succeeds **V. G. Harrison,** who has transferred to the company's Wood River, Ill., refinery. Pratt formerly was manager of personnel and industrial relations for Shell Pipe Line Corp.

George W. Meyer, formerly vice president and general sales manager of the Ada Oil Co., Houston, has assumed duties as vice president of trade relations, a newly created position. **H. A. Cunningham** succeeds Meyer as vice president and general sales manager. **Charles G. Sones** and **Earl G. Gatrell** were named assistant general sales managers.

E. A. Hugill, Jr., has been elected secretary of Shell Oil Co. He also was appointed secretary of Shell Chemical Corp., International Lubricant Corp., and Shell Canadian Exploration Co., and vice president of Shell Development Co. In these jobs he succeeds **J. A. Horner,** who will join Shell Pipe Line Corp. about November 1 and who has been nominated to succeed **Joe T. Dickerson** as president when Dickerson retires on December 31.

Frank Goldstone, manager of administration and services at Shell Development Co.'s exploration and production research division in Houston, will retire October 1 after 37 years with Shell. He was born in England, educated at Cambridge University, and first worked for Shell as a junior engineer in Borneo. He was president of the Society of Exploration Geophysicists in 1942. He will move to London to represent Petty Geophysical, Ltd. He has been made vice president and managing director.

CASAGRANDE

E. W. Casagrande, with Shell 25 years, has been named manager of Shell Chemical Corp.'s Dominguez plant which manufactures industrial chemicals. He succeeds **O. M. Williams,** who becomes manager of the Shell Chemical plant in Denver. For the last 5 years, Casagrande has been manager of Shell's Martinez plant.

Homer C. Wilson, manager of operations for Texas Butadiene & Chemical Corp. at Houston, has been elected a vice president. He will continue to serve as operations manager. He is a University of Texas graduate and served 3 years in World War II as a Navy lieutenant in the Pacific theater.

Vance M. Gilmer, division land manager for Shell Oil Co. in Jackson, Miss., has been appointed area land agent for Shell, headquartering at New Orleans. **D. K. Galtney,** land man for the New Orleans office, has been transferred to Shell's Jackson office to succeed Gilmer.

Howard R. Peterson, Chicago, manager of industrial chemicals for Amoco Chemicals Corp., retired September 1 after 36 years with the company and its affiliates. He plans to begin an 8-month world tour later this month. He was connected with developments that led to patents on oxidation inhibitors as well as improvements in turbine oils and wax manufacturing.

Bruce Scrafford, well-known Houston consulting geologist and oil operator, will be managing director of Argentine operations for Southeastern Drilling Co. with headquarters in Buenos Aires. The company will drill 1,000 wells in Comodoro Rivadavia for YPF, the Argentine oil agency. **Roy A. Bobo,** formerly with Phillips Petroleum Co., Houston, has been appointed manager of the company's drilling operations in Comodoro Rivadavia. **Carrol Stacy,** who has managed the company's activities in India for the last 3 years, will be assistant to Bobo.

C. F. McCoy has been elected vice president of Sinclair Oil & Gas Co. He resigned as vice president and director of Sinclair Pipe Line Co. to take the newly created post. McCoy, formerly with the National Labor Relations Board, will serve as administrative coordinator for six departments. **J. H. Renard,** executive assistant to the president, was named to succeed McCoy as vice president, director, and executive committee member of Sinclair Pipe Line. **A. H. Gibson,** personnel manager, succeeds Renard as executive assistant to the president, and **W. H. Sands,** personnel representative, succeeds Gibson as personnel manager.

▶▶▶ Personals

Donald B. Winfrey, for the past 2 years exploration manager for Cities Service Petroleum, Inc., in Venezuela, has been named assistant to the president of Petty Geophysical Engineering Co., San Antonio. He will direct geophysical operations for the company. He left Petty 8 years ago to organize Winfrey Exploration Co. and in 1957 joined Cities Service.

Harold R. Sneddon, plant and service foreman for Ohio Valley Gas Co., has been named East Liverpool division manager, effective Sept. 1. He has 26 years service with Ohio Valley. He succeeded **W. T. McIntyre,** who retired.

Ken Holke has been named chief geologist of Crescent Petroleum Corp. of Tulsa. He formerly was staff geologist in the foreign exploration department of Sohio Petroleum Co. He received his BS degree from the University of Kansas City and his masters degree from Washington University, St. Louis.

Dr. George G. Oberfell, retired vice president in charge of research and development for Phillips Petroleum Co., on October 21 will receive the Walton Clark medal from Franklin Institute, Philadelphia. Oberfell, holder of 33 patents, is being honored for his contributions to the development of liquefied petroleum gas as a source of domestic fuel.

Robert W. King has been named district geologist for the southern Rocky Mountain district of Kerr-McGee Oil Industries, Inc., with headquarters in Denver. Formerly with Superior Oil Co. 9 years, King succeeds **D. L. Brown,** who is being transferred to Oklahoma City as district geologist for the Mid-Continent region.

J. A. Reid, with Phillips Petroleum Co. since 1933, has been made director of research. He succeeds **W. B. Reynolds,** resigned. Reid formerly was Phillips research director but was loaned to Astrodyne, Inc., in January 1958. Phillips recently announced it is selling its Astrodyne interests to North American Aviation, Inc. Reid spent other periods on loan from Phillips to work on the synthetic-rubber program in Washington and to serve as director of the RFC's office of production for synthetic rubber, tin, and abaca.

H. N. Hockensmith, who has just returned to Houston after 5 years in Spain, has been named vice president of Brown & Root, Inc. In Spain, he was in charge of constructing five major air bases for the U. S. Government. Hockensmith has been with the organization since 1948.

Edward A. Koester is the new president of Four Corners Oil & Minerals Co., Denver. He succeeds **Eugene N. Sanders,** who becomes chairman. The company was formed in June of this year out of Four Corners Uranium Corp. and Four Corners Oil & Gas Co. Koester, a geologist, has been a vice president and director.

John G. McLean, vice president in charge of coordinating and planning for Continental Oil Co., has been named vice president in charge of financial and transportation activities. In his new position, he will direct financial, transportation, marine trans-

McLEAN

PETERS

portation, and aviation operations. **L. C. Peters,** financial vice president, has been appointed vice president in charge of coordination and supply. He will be responsible for Continental's pipeline, crude-oil trading, product supply, and product distribution activities.

Kenneth Newton, regional geologist of Plymouth Oil Co. at Midland, has been named regional supervisor at New Orleans. Newton, a 1946 graduate of Southern Methodist University, has been with Plymouth since 1955. **Arch J. Lair, Jr.,** geologist with Plymouth and a Texas Tech graduate of 1948, has been named regional geologist at Midland.

Henry P. Wheeler, Jr., associated with the government's helium program since 1941, has been named head of the Department of Interior's helium operations. As assistant director for helium in the Bureau of Mines, Wheeler succeeds **Dr. Clifford W. Seibel,** who retired August 31. **Paul V. Mullins,** formerly chief of helium operations, has been named general manager of helium operations with headquarters at Amarillo, Tex.

Richard W. Love has been transferred to Tulsa as assistant superintendent of the Oklahoma district for Texaco, Inc. He formerly was superintendent of Texaco's Salem unit.

Joseph B. Storey, former vice president of Union Producing Co., has joined Southdown, Inc., as vice president in charge of its oil and gas division. Southdown, Inc., formerly Southdown Sugars, Inc., is embarking on a program to increase its oil and gas reserves on the Gulf Coast. Storey has been a director of Southdown since 1954. He has been in charge of Union Producing's drilling and production in Texas, Louisiana, Mississippi, Alabama, and Florida.

John D. Dutton has taken a post as petroleum engineer for Stekoll Petroleum Corp., at Dallas. He formerly held a similar position with Anderson-Prichard Oil Corp., at Great Bend, Kans.

Alfred R. Loeblich has been appointed research associate in paleontology at the La Habra laboratory of the California Research Corp. He has been on the staff since 1957, continuing studies of stratigraphic ranges of planktonic foraminifera.

W. M. Basil will be district landman and **Gregory K. Elias** will be district geologist in the new Amarillo, Tex., office of Monsanto Chemical Co.'s Lion Oil division. Both transferred from the Salt Lake City office, which is being closed. Another Lion Oil office at Liberal, Kans., was closed August 31. Its operations will be handled from Amarillo. Employes from the Liberal office have transferred to Denver, Houston, Midland, and Amarillo.

G. M. Smith has been appointed division sales training supervisor in Tidewater Oil Co.'s western division marketing department. In other changes, **H. V. Heffner** has been named division retail sales supervisor. **D. E. Gordon** has been appointed San Francisco district assistant marketing manager. **R. J. Reid** will be Los Angeles district retail sales supervisor. **G. F. Schilling** has been named San Francisco area sales supervisor, with **F. D. Hamilton** as Avon area sales supervisor.

Personals

MARSHALL

J. Howard Marshall, a vice president, director, and head of the exploration department for Signal Oil & Gas Co., has been elected executive vice president. Marshall's election is one of a series of top-level management changes made by Signal. Five men have been named to the newly created position of senior vice president. They include: **Charles R. Gaylord,** a director of the old Hancock Oil Co. and a vice president and director of Signal since its merger with Hancock; **W. T. Hancock,** executive vice president of the old Hancock firm and Signal's vice president and director in charge of manufacturing; **R. W. Heath,** Signal's vice president and director in charge of the gas department; **O. W. March,** vice president and director of retail marketing; and **G. L. Young,** vice president and director in charge of foreign operations. All six were named to the executive committee. Marshall joined Signal in 1952 after serving 9 years as president of Ashland Oil & Refining Co. He served as chief counsel and assistant deputy of the Petroleum Administration for War from 1941 to 1944. Prior to the war, Marshall was a member of a San Francisco law firm and at one time was assistant dean of the Yale school of law.

Three promotions in the American Oil Co.'s research and development department in Texas City have been announced. **G. W. Jack** has been named division director in charge of product research, and administrative and patent activities; **H. M. Knight** has been named group leader in chemicals research and **H. H. Hammen** has been made senior chemist.

J. Paul Jones, Bradford, has been reelected president and executive manager of the Pennsylvania Grade Crude Oil Association. Other officers reelected are **George J. Hanks,** South Penn Oil Co., Oil City, first vice president; **Fayette B. Dow,** Washington, D. C., vice president and general counsel; and **Samuel Messer,** Quaker State Oil Refining Corp., Oil City, treasurer. **Karney R. Cochran,** Bradley Producing Corp., Wellsville, N. Y., was elected second vice president, succeeding **A. C. Simmons,** Bradford, resigned.

Howard Phipps, Jr., of Bessemer Securities Corp. has been elected to the board of directors of Western Petrochemical Corp. Phipps, a graduate of Harvard, also was named to Western's executive committee.

Roland A. Whealy has been named vice president of Ashland Oil & Refining Co., with headquarters in New York. He formerly was with the Department of Interior's Office of Oil and Gas in Washington.

Mahlon J. Trout, an operator at the Ohio Fuel Gas Co.'s Wellington compressor station, and **Clarence E. Moore,** an engineer with Ohio's Wells compressor station, retired Sept. 1. Moore had 28 years service with Ohio and Trout 24 years.

Nash H. Miller has been named area manager of United Geophysical Co. of Canada, with headquarters in Calgary. He succeeds **S. O. Patterson,** who transferred to Houston as manager of United's eastern U. S. area. Miller joined United in 1937 and has been in Canada since 1952 as technical supervisor.

Robert B. Tenison, Denver independent, has joined Consolidated Oil & Gas, Inc., Denver, as area superintendent at Farmington, N. M. Tenison formerly was president of Tenison Drilling Co., Billings, Mont., and at one time was general superintendent of operation for Snowden Drilling Co., Fort Worth.

J. E. Cauley, Jr., has been named senior chemical engineer in the technical division at Humble Oil & Refining Co.'s Baytown, Tex., refinery. He holds degrees in chemical engineering from the University of Texas. He currently is engaged in designing facilities to increase butyl rubber production.

E. C. Fiedorek has joined British-American Oil Producing Co. in Dallas as a senior staff engineer in the economics and evaluation department. A 1952 graduate of Pennsylvania State University, Fiedorek formerly was with Shell Oil Co. as an exploitation engineer in Midland and Houston.

Ed Arnold, engineer for Falcon Seaboard Drilling Co., has been transferred to the company's headquarters office in Tulsa as drilling engineer for the Mid-Continent area. He joined Falcon Seaboard at Houston after serving with the U. S. Air Force in the Korean conflict. He is a Texas A&M College graduate.

A. E. Worthington, since 1952 a staff member of California Research Corp. directing studies on electrochemistry and chromatography, has been appointed research associate information evaluation at the company's La Habra laboratory. He received degrees in physical chemistry at Northwestern University and the University of British Columbia.

Richard Wagner, chairman of the board of Champlin Oil & Refining Co., Chicago, has been appointed chairman of the U. S. Chamber of Commerce's key Committee on Policy. **M. A. Wright,** a director of Standard Oil Co. (N.J.), New York, has been reappointed as a member of the committee, which recommends chamber policy on important national issues.

Charles H. Dresser, vice president in charge of industrial sales for Anderson-Prichard Corp., has retired after 39 years with the company. Dresser is best known for his work in producing stoddard solvent, developed by W. J. Stoddard, which was the first solvent with a flash point above 100°. Anderson-Prichard first produced the solvent in 1926.

Deaths

Robert Short died September 1 in Jackson, Miss., hospital. He formerly was president of S.H.A. Oil Co., El Dorado, Ark., and was an original member of the Arkansas Oil and Gas Commission.

W. U. Paul, 61, veteran independent oil man, died August 28 in Houston after a 2-month illness. He worked in Oklahoma and Kansas fields in the 1920's, was superintendent for several independent operators in Oklahoma and Louisiana in the 1930's, and since 1935 had been drilling wells in Texas, New Mexico, and Colorado.

W. C. Trammell, 44, Brownwood, Tex., oil man, died at Brownwood August 30.

Augustus Scott DeLee, veteran independent operator at Dallas, died there August 31. DeLee entered the oil business at Burkburnett when he was 18. He retired in 1954.

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District 2 was big LPG market in '58

BY JOHN C. CASPER

TEXAS still holds a long lead in LPG sales but other states are moving up. Domestic and commercial customers in Texas bought 421,201,000 gal. of LPG last year, but the increase over 1957 amounted to only 1.7%.

Illinois ran second with a total of 217,448,000 gal., but here the increase over 1957 was a whopping 37.5%. Oklahoma gained 21.7% for the year to a total of 189,049,000 gal. Sales of 171,325,000 gal. in Missouri represented an increase of 25.9%. These data are taken from the latest report on Sales of Liquefied Petroleum Gases by the Petroleum Economics Branch of the Bureau of Mines.

The table shows comparisons of sales for 1957 and 1958. Note that states in District 2 accounted for better than 44% of all domestic and commercial use last year. This district has been a prime sales area for the past 10 years. In 1948, this North Central area accounted for only 31.2% of the market compared with 37.3% of the total for District 3.

A quick look at the highlights . . .

	LATEST WEEK	Change from WEEK AGO		Change from YEAR AGO	
Production	6,772,000	UP	1,000	DOWN	79,000
Crude stocks	258,080,000	DOWN	3,768,000	UP	7,049,000
Completions	1,013	UP	62	UP	152
Refinery runs	8,362,000	UP	148,000	UP	425,000
Gasoline stocks	183,082,000	UP	1,660,000	UP	9,612,000
Kerosine stocks	31,044,000	UP	1,096,000	UP	2,420,000
Distillate stocks	159,541,000	UP	5,857,000	UP	21,219,000
Residual stocks	56,449,000	UP	382,000	DOWN	10,569,000
Four-product stocks	430,116,000	UP	8,995,000	UP	22,682,000
Total imports	1,324,900	DOWN	260,100	DOWN	228,500

Over the past 10 years, sales in Districts 1, 2, and 4 have grown faster than the national rate. Growth has been slower than the national average for Districts 3 and 5. There are at least two reasons for the lower gains in District 3. First, markets developed early in this area because of the short hauls from plant to customer. And second, the domestic market potential is limited by mild winter weather and the recent push for more intrastate sales of natural gas.

In the national total, domestic and commercial sales accounted for 44.1% of all LPG and LRG. The second-ranking market was chemical use with 25.5% of the total. Other uses in order were: internal combustion with 11.4%, synthetic rubber with 5.0%, gas manufacturing with 3.2%, refinery fuel with 2.4%, secondary oil recovery with 0.9%, and all other with 0.9%.

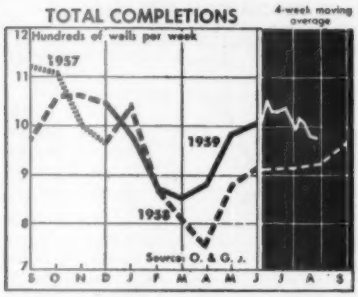
Sales of LP Gas and LR Gas

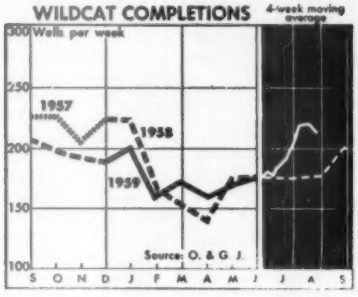
(Thousands of gallons)

	Domestic and commercial		Total	
	1958	1957	1958	1957
Dist. 1	**663,999**	**645,171**	***1,260,243**	***1,208,852**
Connecticut	26,245	25,649	39,245	42,053
Delaware	10,574	9,474	14,697	15,511
Florida	130,968	107,681	198,646	153,491
Georgia	60,893	69,422	109,106	96,853
Maine	19,100	18,672	21,150	22,066
Maryland and D. C.	29,327	30,702	39,661	41,065
Massachusetts	35,725	33,287	43,484	40,370
New Hampshire	13,595	13,045	16,565	16,028
New Jersey	37,766	35,384	101,082	90,840
New York	91,087	80,696	110,116	101,674
North Carolina	57,320	64,173	82,039	84,767
Pennsylvania	54,080	50,525	107,541	119,137
Rhode Island	6,674	6,775	7,848	7,586
South Carolina	41,820	43,348	58,600	55,550
Vermont	9,054	10,972	12,818	14,284
Virginia	33,038	39,125	38,195	45,686
West Virginia	6,733	6,241	215,676	220,415
Dist. 2	**1,465,152**	**1,259,936**	***2,286,697**	***2,054,350**
Illinois	217,448	158,091	459,513	395,337
Indiana	123,051	88,728	188,782	141,769
Iowa	85,206	87,741	102,679	109,677
Kansas	127,291	138,711	168,235	183,126
Kentucky	52,933	50,722	127,930	155,672
Michigan	72,142	62,892	95,837	97,897
Minnesota	116,305	94,623	154,263	125,178
Missouri	171,325	136,088	198,297	160,794
Nebraska	63,822	69,038	81,889	87,876
North Dakota	26,150	33,431	35,352	46,463
Ohio	73,412	46,818	94,240	66,723

	Domestic and commercial		Total	
	1958	1957	1958	1957
Dist. 2 (Contd.)				
Oklahoma	189,049	155,376	279,621	224,122
South Dakota	34,880	43,041	44,910	57,544
Tennessee	32,025	33,541	44,633	43,029
Wisconsin	80,113	61,095	126,680	117,912
Dist. 3	**806,612**	**789,418**	***3,223,519**	***2,976,695**
Alabama	90,350	65,158	106,664	77,977
Arkansas	112,037	100,124	161,498	137,825
Louisiana	48,612	68,916	307,895	292,657
Mississippi	73,001	82,971	100,971	107,410
New Mexico	53,411	50,364	96,015	99,365
Texas	429,201	421,885	2,375,860	2,185,240
Dist. 4	**120,629**	**147,410**	***170,200**	***193,964**
Colorado	75,506	70,380	95,876	89,821
Idaho	8,233	12,977	10,408	15,709
Montana	10,152	23,143	12,439	27,759
Utah	8,513	12,266	12,000	17,360
Wyoming	18,225	28,644	29,224	37,434
Dist. 5	**237,285**	**225,135**	***521,430**	***505,260**
Arizona	21,792	16,204	35,777	26,945
California	157,281	150,108	355,391	349,270
Nevada	7,589	7,405	22,892	22,025
Oregon	32,215	33,417	48,742	52,710
Washington	18,408	18,001	22,895	28,157
Total U. S.	**3,293,677**	**3,067,070**	**7,462,089**	**6,939,121**

*Includes LPG used as refinery fuel or for secondary recovery, not reported by states.





Active Rotary Rigs

	8-31-59	8-24-59	9-1-58
Alabama	9	9	5
Arkansas	14	14	23
Arizona	2	2	3
California	100	92	67
Land	94	90	(*)
Offshore	6	2	(*)
Colorado	57	56	50
Florida	1	2	1
Land	1	1	1
Offshore	0	1	0
Illinois	44	39	62
Indiana	9	7	12
Iowa	2	2	3
Kansas	130	129	159
Kentucky	8	7	5
Louisiana	334	345	302
North	39	46	34
S. Inland waters	135	139	(†)
S. Land	108	110	233
Offshore	52	50	35
Maryland	0	0	0
Michigan	31	28	10
Mississippi	69	74	40
Missouri	0	1	1
Montana	30	28	19
Nebraska	29	27	21
Nevada	1	1	0
New Mexico	120	117	103
New York	0	1	2
North Dakota	27	25	29
Ohio	3	3	0
Oklahoma	203	201	191
Oregon	0	0	0
Pennsylvania	11	12	9
South Dakota	9	7	3
Texas	748	791	701
S. Inland waters	5	5	(†)
S. Land	198	215	136
Offshore	2	1	0
North-East	184	179	(*)
West Central	235	250	(*)
West	124	141	(*)
Utah	33	34	22
Washington	2	2	1
West Virginia	8	8	4
Wyoming	73	76	63
Total U. S.	2,107	2,140	1,911
Western Canada	136	163	132
Eastern Canada	0	0	4
Grand total	2,243	2,303	2,067

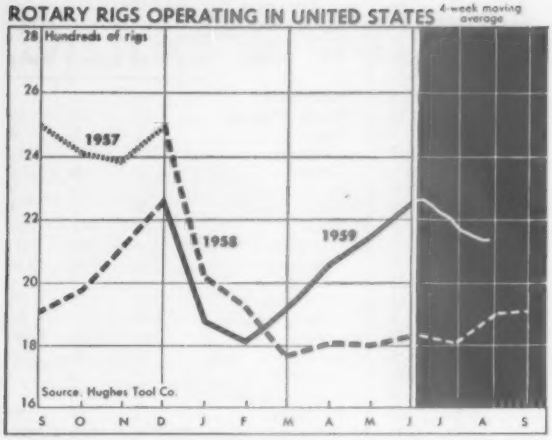
Hughes Tool Co. report. *Comparisons not available due to change in method of reporting. †Included in South-Land.

WEEKLY WELL COMPLETIONS . . . WEEK ENDED AUGUST 29, 1959

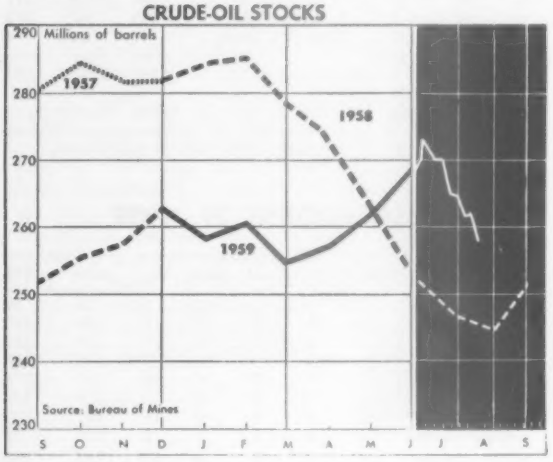
	Total wells							Cum.		Total wildcats					Cum.	
	Total	Crude	Cond.	Gas	Dry	Service	Footage	1959	1958	Total	Crude	Cond.	Gas	Dry	1959	1958
Alabama	2	2	0	0	0	0	23,172	63	50	0	0	0	0	0	16	19
Arkansas	9	5	0	0	4	0	30,815	551	478	3	1	0	0	2	96	110
California	25	15	0	2	7	1	133,388	992	1,079	8	1	0	2	5	248	248
Colorado	17	5	1	1	10	0	99,839	502	534	10	2	0	1	7	300	308
Illinois	57	26	0	1	30	0	116,312	1,455	1,402	7	1	0	0	6	241	276
Indiana	16	8	0	0	8	0	24,566	538	489	6	2	0	0	4	178	180
Kansas	77	40	0	0	35	2	259,988	2,647	2,469	21	3	0	0	18	627	533
Kentucky	70	24	0	35	11	0	167,613	1,614	744	4	0	0	1	3	143	85
Louisiana	106	49	7	7	42	1	767,172	2,415	2,260	14	0	0	1	13	326	332
North	53	22	1	7	23	0	200,528	907	811	10	0	0	1	9	138	136
South	41	22	5	0	13	1	425,221	1,253	1,147	3	0	0	0	3	175	177
Offshore	12	5	1	0	6	0	141,423	255	302	1	0	0	0	1	13	19
Michigan	17	11	0	1	3	2	49,851	413	276	4	0	0	1	3	103	91
Mississippi	12	2	0	0	10	0	101,388	410	256	8	1	0	0	7	187	119
Montana	5	1	0	0	4	0	11,246	210	217	1	0	0	0	1	63	91
Nebraska	22	4	0	0	18	0	129,464	581	463	8	0	0	0	8	250	216
New Mexico	45	30	2	1	12	0	138,924	1,342	1,313	3	0	0	0	3	159	172
West	13	10	2	0	1	0	43,826	609	634	0	0	0	0	0	44	74
East	32	20	0	1	11	0	95,098	733	679	3	0	0	0	3	115	98
New York	0	0	0	0	0	0	0	172	393	0	0	0	0	0	16	32
North Dakota	6	5	0	0	1	0	10,390	326	297	0	0	0	0	0	61	97
Ohio	27	13	0	7	5	2	67,837	643	708	3	0	0	1	2	21	11
Oklahoma	88	48	1	5	31	3	342,240	3,789	4,205	19	3	1	3	12	564	583
Pennsylvania	0	0	0	0	0	0	0	335	418	0	0	0	0	0	9	9
Texas	360	190	10	12	142	6	1,590,412	12,604	11,810	70	6	1	1	62	2,371	2,405
District 1	18	11	0	1	6	0	33,397	749	638	3	0	0	0	3	214	257
District 2	9	1	0	1	7	0	54,409	526	499	2	0	0	0	2	156	131
District 3	25	9	3	0	13	0	169,483	800	847	5	0	0	0	5	156	191
District 4	31	11	1	2	17	0	148,203	878	782	12	0	0	0	12	218	227
East	36	25	1	0	10	0	153,159	810	811	6	0	0	0	6	156	224
District 7-B	57	22	0	2	33	0	176,959	1,736	1,582	17	3	0	1	13	456	445
West	102	74	3	0	25	0	568,454	3,872	3,429	16	2	1	0	13	541	479
District 9	56	25	0	4	24	3	165,507	2,355	2,385	7	1	0	0	6	401	385
District 10	26	12	2	2	7	3	120,841	878	837	2	0	0	0	2	73	66
Utah	4	1	0	0	3	0	24,630	205	264	2	1	0	0	1	56	56
West Virginia	17	3	0	13	1	0	34,430	511	477	0	0	0	0	0	18	12
Wyoming	28	11	0	0	17	0	144,700	651	476	14	1	0	0	13	222	138
Misc. (Fla., Ariz.)	3	0	0	1	2	0	25,041	87	63	3	0	0	1	2	54	54
Total U. S.	1,013	493	21	86	396	17	4,293,418	33,056	31,141	208	22	2	12	172	6,329	6,177
Prev. week	951	485	19	55	365	27	4,110,312	.....	.....	220	16	3	8	193	.....	.....
Cum. 1959	33,056	16,702	802	2,402	12,294	856	137,300,507	.....	.....	6,329	602	84	196	5,447	.....	.....
Cum. 1958	31,141	15,296	767	2,373	11,912	793	129,561,438	.....	.....	6,177	607	106	185	5,279	.....	.....
Western Canada	43	24	0	8	11	0	186,147	1,640	1,607	7	2	0	1	4	466	436
Ontario	0	0	0	0	0	0	0	154	.....	....	....	....	....	....	.....	.....

PRODUCTION

ROTARY RIGS OPERATING IN UNITED STATES



CRUDE-OIL STOCKS



CRUDE-OIL STOCKS BY STATES OF ORIGIN*

(Thousands of barrels)

	8-22-59	8-15-59	8-23-58
Pennsylvania	2,685	2,631	2,948
Other Appalachian	2,128	1,956	1,408
Illinois, Indiana, Michigan	9,811	9,974	11,334
Nebraska and North Dakota	3,060	2,910	2,218
Kansas	10,005	9,797	9,442
Oklahoma	15,832	16,315	15,947
Arkansas	2,148	2,124	1,705
Louisiana	18,761	19,243	16,668
North	3,283	3,368	2,964
South	15,478	15,875	13,704
Mississippi, Alabama, Florida	2,639	2,688	2,539
New Mexico	7,857	7,837	7,853
Texas	110,569	113,874	102,880
East Texas	8,707	8,837	7,713
West Texas	52,673	53,662	50,678
Texas Gulf	19,202	19,902	18,072
Other Texas	29,987	31,473	26,417
Wyoming	15,787	15,573	13,793
Other Rocky Mountain	10,019	9,724	9,305
California	31,429	31,763	36,323
Foreign	†15,350	15,439	16,678
Total	**258,080**	261,848	251,041

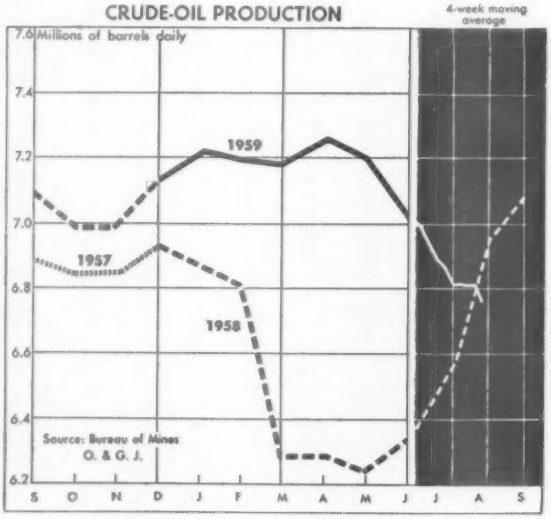
*Bureau of Mines. †Includes 4,665,000 bbl. in California.

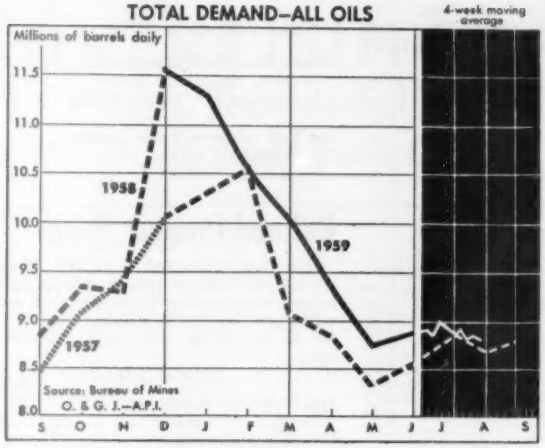
DAILY AVERAGE PRODUCTION FOR WEEK

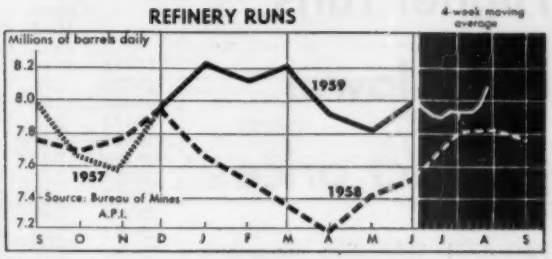
	August 29, 1959 Crude oil	Lease condensate	Total	Aug. 22 total
Alabama	16,150	.....	16,150	16,100
Arkansas	46,230	270	46,500	46,050
California	847,500	.....	847,500	844,800
Colorado	126,100	.....	126,100	124,000
Eastern	40,000	.....	40,000	41,000
Florida	1,130	.....	1,130	1,130
Illinois	211,300	.....	211,300	211,800
Indiana	32,400	.....	32,400	32,300
Kansas	†312,140	.....	†312,140	†309,480
Kentucky	92,800	.....	92,800	92,700
Louisiana	894,800	97,500	992,300	§992,000
North	109,800	5,000	114,800	114,500
South	785,000	92,500	877,500	§877,500
Michigan	27,400	.....	27,400	27,600
Mississippi	133,500	3,750	137,250	137,250
Montana	79,600	.....	79,600	78,700
Nebraska	62,400	.....	62,400	61,900
Nevada	100	.....	100	100
New Mexico	280,500	5,000	285,500	285,500
North Dakota	38,800	.....	38,800	39,500
Oklahoma	†509,000	.....	†509,000	†514,160
Texas	2,386,000	70,480	2,456,480	2,456,480
Dist. 1	43,000	2,300	45,300	45,300
Dist. 2	99,000	7,600	106,600	106,600
Dist. 3	315,000	35,500	350,500	350,500
Dist. 4	168,000	8,500	176,500	176,500
Dist. 5	28,000	350	28,350	28,350
Dist. 6	102,000	6,200	108,200	108,200
East Texas field	129,000	.....	129,000	129,000
Dist. 7-B	130,000	100	130,100	130,100
Dist. 7-C	113,000	3,230	116,230	116,230
Dist. 8	945,000	4,000	949,000	949,000
Dist. 9	205,000	1,600	206,600	206,600
Dist. 10	109,000	1,100	110,100	110,100
Utah	114,900	.....	114,900	114,400
Wyoming	342,300	.....	342,300	344,100
Others	‡340	.....	‡340	‡240
Total U. S.	6,595,390	177,000	**6,772,390**	§6,771,290
Change from previous week, up			**1,100**	
Canada	†555,300	.....	†555,300	†563,900
Total U. S. production—January 1-August 29				§1,706,638,630
Same period last year (crude plus cond.)				*1,574,709,780 bbl.

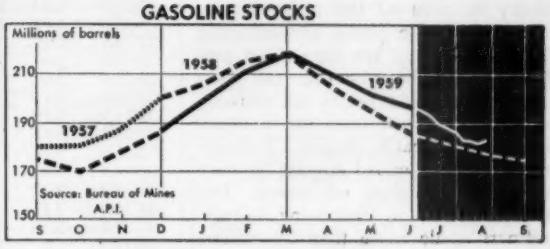
*Includes 37,906,470 bbl. condensate. †Week ended previous Monday. ‡Arizona, South Dakota, and Washington. §Revised. Louisiana production was overstated 56,000 bbl. daily for first 3 weeks of August. The error was due to misinterpretation of a portion of the August allowable order.

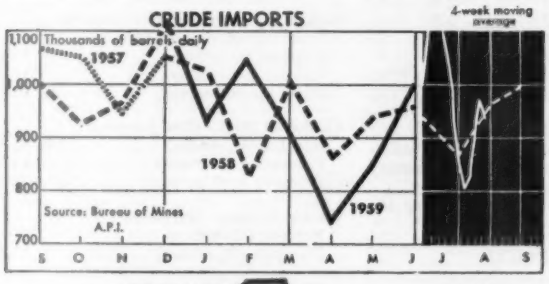
CRUDE-OIL PRODUCTION

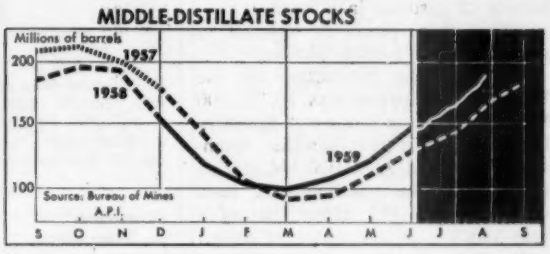


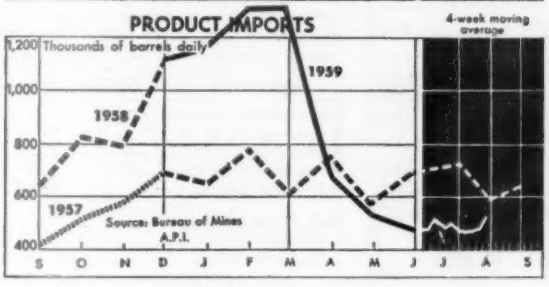


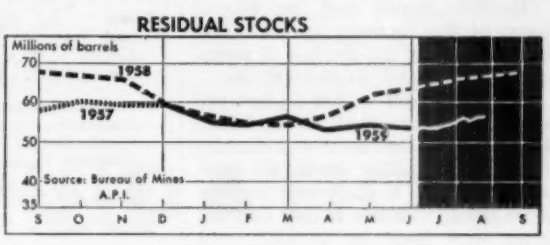












API REFINERY REPORT, AUGUST 28, 1959

(Thousands of barrels)

District—	Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.	Stocks‡ Gaso.†	Kero.	Dist.	Resid.	Bureau of Mines, Aug. 1958 Daily avg. runs	Daily average production Gaso.*	Kero.	Dist.	Resid.
East Coast	1,188	558.0	33.3	328.8	147.4	44,245	12,177	60,774	11,073	444.7	522.0	25.2	283.3	175.9
Appalachian:														
District 1	100	42.3	3.6	22.0	6.4	5,744	616	3,713	362	96.0	43.9	3.3	21.0	5.9
District 2	105	54.6	1.9	17.9	8.4	2,731	500	1,576	390	104.5	56.6	5.2	19.7	9.3
Ind., Ill., Ky.	1,569	797.4	74.8	316.3	156.5	31,723	7,509	26,557	5,433	1,372.7	750.9	55.3	288.8	123.8
Minn., Wis., Dak.	105	52.4	0.6	27.9	10.9	6,584	1,365	7,258	451	51.3	54.3	4.0	29.8	8.1
Okla., Kans., Mo.	723	394.5	9.7	184.6	17.6	16,512	1,559	11,163	813	752.1	429.1	13.5	176.5	23.1
Inland Texas	310	221.9	8.0	54.9	21.6	7,338	534	2,042	2,146	283.3	207.0	7.6	52.2	19.0
Texas Gulf Coast	1,935	1,020.4	113.1	439.1	178.9	21,624	3,148	18,461	6,105	1,740.2	952.3	89.8	442.3	184.1
La. Gulf Coast	683	402.9	52.7	177.7	45.1	9,922	1,906	7,394	1,482	652.4	369.0	48.1	145.4	47.2
N. La. and Ark.	65	30.3	1.0	13.0	3.9	4,619	907	2,234	221	93.0	40.3	6.4	22.0	5.7
Rocky Mountain:														
New Mexico	25	12.6	0.9	4.4	3.1	791	41	181	92	24.4	12.9	0.4	4.8	2.1
Other Rky Mt.	325	152.3	3.4	61.0	38.3	4,583	371	2,991	1,127	282.5	133.9	2.4	57.4	30.9
West Coast	1,229	569.3	....	188.7	267.3	26,666	411	15,197	26,754	916.9	509.4	3.4	162.5	325.8
Aug. 28, 1959	8,362	4,308.9	303.0	1,836.3	905.4	183,082	31,044	159,541	56,449	6,814.0	4,081.6	264.6	1,705.7	960.9
Aug. 21, 1959	8,214	4,188.0	294.1	1,885.3	891.6	181,422	29,948	153,684	56,067	.....	.....	.....	.....	.....
Aug. 29, 1958	7,837	4,029.4	282.6	1,699.3	1,040.9	173,470	28,624	138,322	67,018	.....	.....	.....	.....	.....

*At refineries including natural blended. †Finished and unfinished. ‡At refineries, bulk terminals, in transit, and in pipelines.

Higher runs bring lower product prices

PRODUCT MARKETS are a little shaky in most of the major supply areas. Distillate prices are softening in some areas at the time when jobbers should be planning fall purchases. Gasoline prices are showing a definite reaction from the increases in July and early August. Refinery runs for week ended August 28 were next to the highest on record. For the first time in processing history, refiners made more than 30 million barrels of gasoline in a week.

All of these pieces fit together to give a gloomy market picture.

Total gasoline production for the last week of August was 30,162,000 bbl. Proof that this rate was excessive lies in the fact that gasoline inventories increased 1,660,000 bbl. during the week. The gasoline-stock level was 9,612,000 bbl. above that of a year ago.

Distillate stocks took the biggest jump of the summer, up 5,857,000 bbl. Additions for the last 2 weeks of August totaled 11,600,000 bbl.

The end result is that jobbers are shopping for low offers on No. 2 fuel. Formal quotations for No. 2 fuel on the Group 3 market are at 8.0 cents a gallon. This is the lowest summer price since 1954, and in that year the price went back up to 8.25 cents before the end of August. There are reports that even the 8.0-cent price has been shaded. Some interrefinery sales are rumored to be at prices under 7.75 cents.

Gulf Coast refiners have been holding out for the low or 7.75 cents for No. 2, but Gulf-East Coast distillate stocks increased almost 2,500,000 bbl. in the last week of August. Unless drastic cuts are made in runs and distillate production for these districts, distillate prices will get worse before they get better.

Formal postings for 92-octane regular gasoline on the Gulf Coast is 11.00 cents a gallon, but less-than-cargo sales have gone as low as 10.75 cents.

There has been no report of a definite break in the Group 3 gasoline market, but shifts in sales to large jobbers along the pipeline indicate that some regular may be moving at 11.50 cents a gallon.

Crude-Oil Prices

GRAVITY SCHEDULE

	Signal Hill,§ Calif.	Oklahoma	Gulf Coast Tex.*	West Tex.† N.M. (sour)	Wyo.
14-14.9	$1.86	....	....	....	....
15-15.9	1.95	....	....	....	$1.81
16-16.9	2.04	....	....	....	1.86
17-17.9	2.13	....	....	....	1.91
18-18.9	2.23	....	....	....	1.96
19-19.9	2.32	....	....	....	2.01
20-20.9	2.41	$2.49	....	$2.35	2.06
21-21.9	2.50	2.52	....	2.38	2.11
22-22.9	2.60	2.55	....	2.41	2.16
23-23.9	2.69	2.58	$3.44	2.44	2.21
24-24.9	2.78	2.61	3.46	2.47	2.26
25-25.9	2.84	2.64	3.48	2.50	2.31
26-26.9	2.90	2.67	3.50	2.53	2.36
27-27.9	2.95	2.70	3.52	2.56	2.49
28-28.9	3.01	2.73	3.54	2.59	2.54
29-29.9	3.07	2.76	3.56	2.62	2.59
30-30.9	3.12	2.79	....	2.65	2.63
31-31.9	3.20	2.82	....	2.68	2.67
32-32.9	3.27	2.85	....	2.71	2.71
33-33.9	3.34	2.88	....	2.74	2.75
34-34.9	3.41	2.91	....	2.77	2.79
35-35.9	3.47	2.94	....	2.80	2.83
36-36.9	3.52	2.97	....	2.83	2.87
37-37.9	3.56	2.99	....	2.86	2.89
38-38.9	....	3.01	....	2.89	2.91
39-39.9	....	3.03	....	2.92	2.93
40-40.9	....	3.05	....	2.95	2.95

*Low cold test crude. †Sour.

Effective dates of broad changes: California, 1-26-59; East of California, January 3-10, 1957; Pennsylvania Grade 4-1-59.

§Union Oil Co. of California posting 10c to 50c less per barrel.

FLAT PRICES

Louisiana:	
Sweet Lake	$3.00
Texas:	
East Texas	3.05-3.25
Conroe	3.53
Van	3.08
Pennsylvania Grade:	
Bradford	4.25
Middle District	4.07
Southwest Pennsylvania	3.80
West Virginia	3.62
Buckeye Grade	3.47
Illinois Basin	**3.00**

FOREIGN

Canada:	
Leduc-Woodbend	2.53
Redwater (Alta.)	2.42
Smiley (Sask.)	2.18
Pembina	2.38
Venezuela:	
Cumarebo, 48°-49.9°, Tucupido	3.34
San Joaquin, 41°-41.9°, Puerto La Cruz	3.08-3.10
Oficina, 35°-35.9°, Puerto La Cruz	2.80
Tia Juana medium, 26°-26.9°, Amuay*	2.30
Quiriquire, 16.0°-16.4°, Caripito	2.10
Lagunillas heavy, flat, Las Piedras*	2.10
Bachaquero, flat, 15°-16°, Las Piedras*	1.88

Prices for all crudes of 24° or lighter vary 2 cents per degree change, up or down. All crudes heavier than 24° vary 2.5 cents per half-degree gravity change.

*Also available at La Salina at 3 cents per barrel less.

Middle East, Persian Gulf (cargoes f.o.b. lifting port):	
Arabian, about 34°, Ras Tanura	$1.89
Iranian, 34.0°-34.9°, Bandar Masur	1.86
Iranian, 34.0°-34.9°, Abadan	1.81
Iraq, 36.0°-36.9°, Fao	1.82
Kuwait, 31.0°-31.9°, Mina-al-Ahmadi	1.67
Qatar, about 41°, Um Said	2.05
Middle East, E. Mediterranean:	
Arabian, about 35°, Sidon	2.29
Iraq, about 35°, Tripoli, Banias	2.29
Far East (cargoes, f.o.b. Lutong, Sarawak):	
Seria Light, 37°	2.57

Refined-Product Prices

Following quotations are for refinery products in cents per gallon moving in interstate shipments on Wednesday each week unless otherwise noted. Crude-oil prices are per barrel at the wells unless otherwise listed.

GASOLINE*

Mid-Continent (Group 3):	
Regular (91 octane)	11.75-12.00
Premium (99 octane)	14.50-14.75
Gulf Coast (cargoes for coastwise or export movements):	
Regular (90 octane)	10.75
Regular (92 octane)	11.00
Premium (98 octane)	12.25
California (rack) (Los Angeles):	
Regular (88 octane)	12.00-12.50
Premium (94 octane)	13.00-13.50
Premium (100 octane)	14.50-15.00
Caribbean area (cargoes):	
Regular (87 octane)	10.375
Premium (97 octane)	12.00

*Quotations are for octanes shown. Prices usually vary with octane ratings within the regular, premium, and aviation grades.

KEROSINE AND DISTILLATE

Mid-Continent (Group 3):	
★ Kerosine 42-44	9.00-9.50
★ Diesel oil (58 d.i. and above)	8.75-9.25
★ Distillate No. 1	8.75-9.25
★ Distillate No. 2	8.00-8.50
Gulf Coast (cargoes):	
Kerosine 41-43	8.25-8.375
Distillate No. 2	7.75-7.875
New York Harbor (barges):	
Kerosine 41-43	9.60
Distillate No. 2	9.10
Diesel fuel, 48-52 d.i.	9.40
Caribbean area (cargoes):	
Distillate No. 2	8.125

★Denotes change from previous week.

RESIDUAL FUEL (BBL.)

Mid-Continent (Group 3):	
Residual fuel (max. 1% S)	$1.75-1.90
Gulf Coast (cargoes):	
Bunker C fuel	$2.00
New York Harbor (barges):	
Bunker C fuel	$2.37
Caribbean (cargoes):	
Bunker C	$2.00
California (rack):	
Bunker C fuel, Los Angeles	$2.15

Tanker Rates (Long Ton)

(Latest reported spot fixtures)

Gulf-USNH, dirty (ATRS—32.5%)	$1.92
★ Carib.-USNH, dirty (ATRS—50%)	1.38
★ PG-Italy, dirty (Scale —57.5%) (20s. 6d.)	2.87

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GEOPHYSICIST: 21 years experience in in interpretation and supervision in the United States. Concentrated experience in the Gulf Coast Region. Desire position in geophysics with Houston base. Box L-463, The Oil and Gas Journal, Tulsa, Oklahoma.

PETROLEUM GEOLOGIST, B.S., Age 23, Married. One summer surface mapping and well sitting. Two years schooling petroleum engineering. Three summers surveying. Finished active military obligation. Box L-476, The Oil and Gas Journal, Tulsa, Oklahoma.

GEOLOGIST, M.S. Degree, 6 years varied subsurface—surface experience, 3 years in Kentucky and Tennessee. Presently employed in above area—desires new affiliation with company or independent. References, published material. Box L-485, The Oil and Gas Journal, Tulsa, Oklahoma.

REFINERY SHIFT FOREMAN, DESIRES foreign or domestic assignment. Fifteen years of construction, maintaince and operating experience on all types of processing equipment. Agency replies welcome. Resume on request: Box L-488, The Oil & Gas Journal, Tulsa, Oklahoma.

SENIOR GEOLOGIST—Seismologist, Major, Independent, Constultant, Foreign and Gulf Coast experience, particularly South Texas. Resume on request. Box L-483, The Oil and Gas Journal, Tulsa, Okla.

SAFETY ENGINEER—Age 32—8 years experience, 3 years in Production & Refinery. 5 years in Drilling Operations in Oklahoma, Kansas, Texas, Louisiana, Offshore and Rocky Mountain Area. B.S.—Industrial Education. Box L-486, The Oil and Gas Journal, Tulsa, Oklahoma.

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U. S. DEPARTMENT OF THE INTERIOR, Bureau of Land Management, Land Office, Salt Lake City, Utah. Notice is hereby given that approximately 240 acres of land in two parcels within the known geologic structure of the Bar-X Field, Utah, will be offered for competitive oil and gas leasing through sealed bids to the qualified bidder of the highest cash amount per acre at 1:00 P.M. M.S.T., October 15, 1959, when bids will be opened. Full details of the lease offering, and how and where to submit bids, may be obtained from the Manager, Land Office, 312 Federal Building, Salt Lake City, Utah.

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WANTED: 250,000 barrels and up, or equivalent gas, fair price, cash, with or without development drilling and/or drilling deals. Box L-441, The Oil and Gas Journal, Tulsa, Oklahoma.

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Midwest fabricators, jobbers and distributors of pipe, sheets, plates, tubing, fittings and tubular goods desire to acquire one or more corporations in related line of business for purpose of expansion. Would consider company in unfavorable current earning position or in need of financial assistance. Replies treated confidentially. Box L-439, The Oil and Gas Journal, Tulsa, Oklahoma.

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LEGAL

DEPARTMENT OF THE Interior, Bureau of Indian Affairs, Jicarilla Indian Agency, Dulce, New Mexico. Sealed bids will be received until 3:00 P.M., Mountain Standard Time, September 30, 1959, and then opened at that time in the Office of the Jicarilla Indian Agency, Dulce, New Mexico, for the leasing of 46,531 acres of Tribal Indian land located in Rio Arriba County, New Mexico, within the Jicarilla Indian Reservation, for oil and gas mining purposes. The details of the lease offering and how and where to file bids may be obtained by addressing an inquiry to the Superintendent of the Jicarilla Indian Agency, Dulce, New Mexico.

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The Oil and Gas Journal
Box 1260 Tulsa, Okla.

EQUIPMENT MEN . . . in the News

Oshry named technical director

. . . of Well Surveys, Inc., according to John J. Neale, president. In this new post, Dr. Howard Oshry will be in charge of research, testing, and prototype manufacturing facilities and personnel.

For the past 6 months, Oshry has been a staff assistant in Dresser's Dallas offices. Before joining Dresser, he was with the electronic engineering laboratories of Convair in San Diego. Earlier, Oshry served as director of research for Erie Resistor Corp.

Lester Sanders appointed g.m.

. . . of Nowery J. Smith Co., a member-firm in the Smith Industries, reports Tyson Smith, president of Smith Industries, Inc., Houston. Prior to his promotion, Sanders served as general office manager.

Sanders joined the Smith Industries in 1948. During the past 11 years, he has held positions as bookkeeper, credit manager and purchasing agent, and special assistant to the president.

Philip L. Robbins is appointed

. . . district sales representative in Natchez, Miss., for Baash-Ross Division of Joy Mfg. Co., according to H. L. Messinger, Baash-Ross sales manager. Robbins formerly was district manager for Lane-Wells Co. in Natchez.

Sales engineer is transferred

. . . and four others are appointed by the Delta-Desco Companies of Shreveport, announces C. F. Clure, Delta-Desco president. Charles Martindale has been transferred from the southeastern area to Houston to cover the Houston and Corpus Christi territories.

New men include Searle Walton, Philadelphia; Jerry Alexander, Charleston; Dan Abbott, Tampa; and Jack Sachse, Tulsa.

Graver Tank & Mfg. Co. wins

. . . highest honors of the 1959 Putnam awards for industrial advertising for outstanding work on the company's elevated water-storage tanks. Graver is a division of Union Tank Car Co.

Plaques and prizes of $1 thousand each were awarded to H. J. D'Aragon general sales manager, and Robert F. Millett, advertising manager, who were primarily responsible for the campaign which brought a substantial increase in inquiries and sales of Graver's water towers.

Graver was the only midwestern company to attain highest honors in the 1959 Putnam competition, which brought entries from 47 companies. The awards are sponsored by the Poor Richard club of Philadelphia with Putnam Publishing Co. of Chicago.

Testing Machines announces

. . . a complete series of new testing machines for the petroleum industry. Arrangements have been completed for the sale and service in the United States of a line of petroleum testers manufactured by F. J. Hone & Co., Ltd., of London.

Purchasing and technical executives are entitled to receive a complimentary copy of a 224-page reference manual and register of testing machines by writing to: Testing Machines, Inc., Dept. OGJ, 72 Jericho Turnpike, Mineola, N. Y.

Robert D. Evans is named

. . . to head the technical sales and service office in Houston of Girdler Catalysts, a unit of Chemetron Corp.'s Chemical Products Division. He succeeds Merle R. Likins, who has joined the technical service staff at Girdler's Louisville headquarters. Evans was with E. I. du Pont before joining Girdler in 1957.

Likins had been head of Girdler's Houston branch office since it was organized last year. He was a senior chemist at Clayton & Lambert Mfg. Co. before joining Girdler 4 years ago.

Donald Dixon is assigned

. . . to the Houston branch office of Cooper-Bessemer Corp., announces George Edick, domestic sales manager. In his capacity as sales engineer, Dixon will work under the direction of Earl Martin, Houston branch manager.

Dixon previously was located at the company's sales office in Tulsa and at the main plant in Mount Vernon, Ohio.

Walworth Co. appoints Snell

. . . as a sales representative in the firm's Gulf division, which comprises most of southern Louisiana. Before beginning with Walworth, Leroy Snell was manager of a Louisiana supply company.

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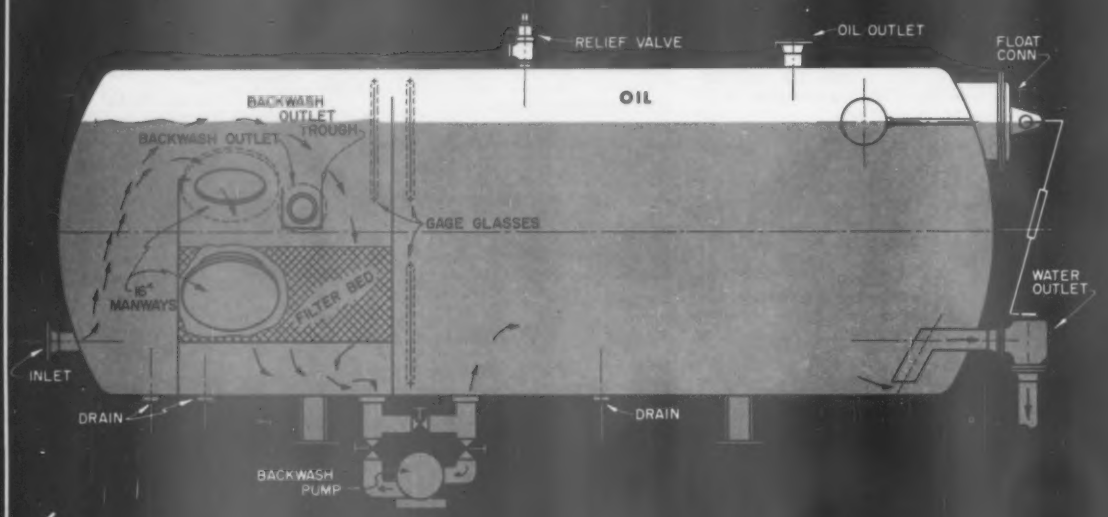

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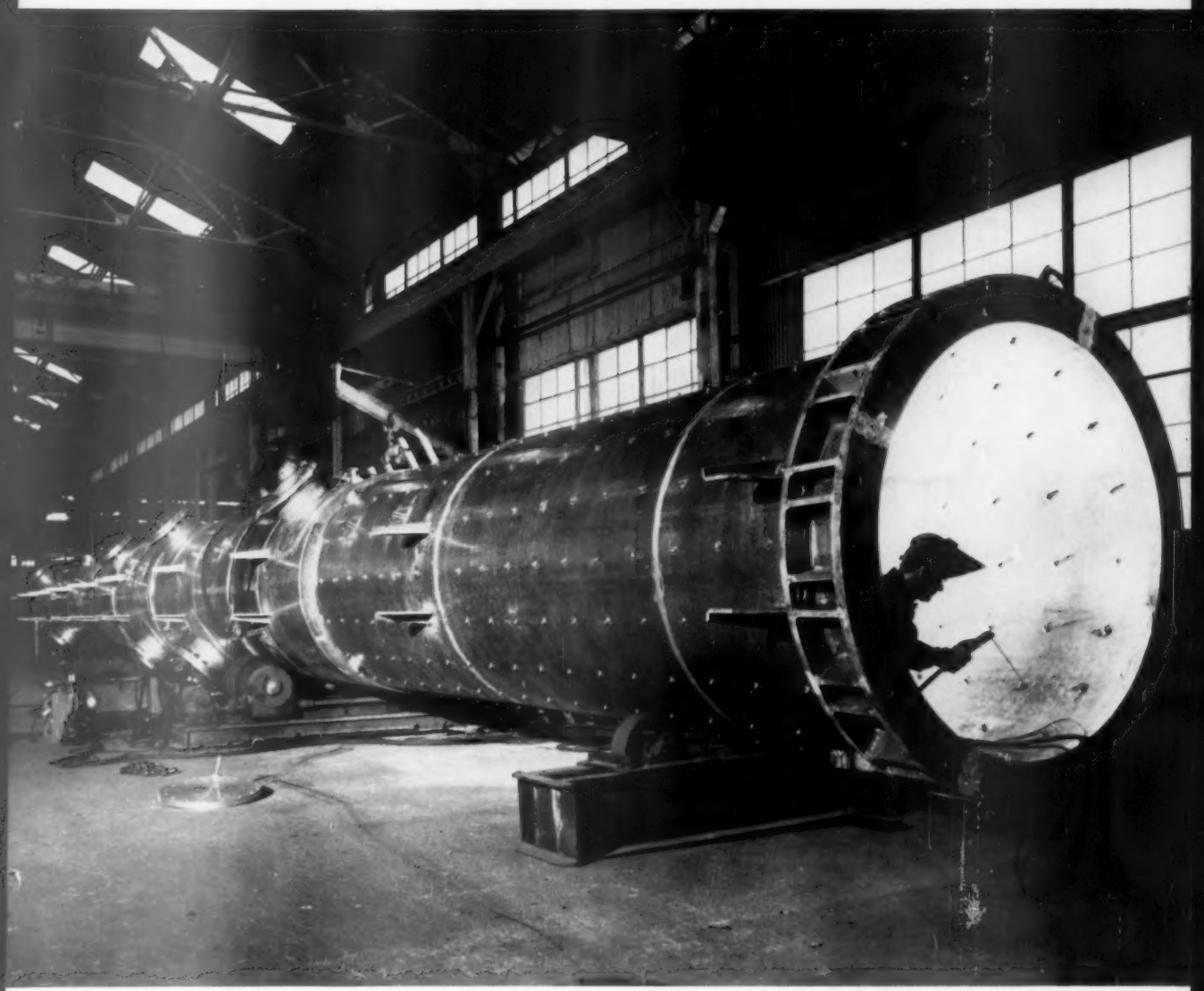

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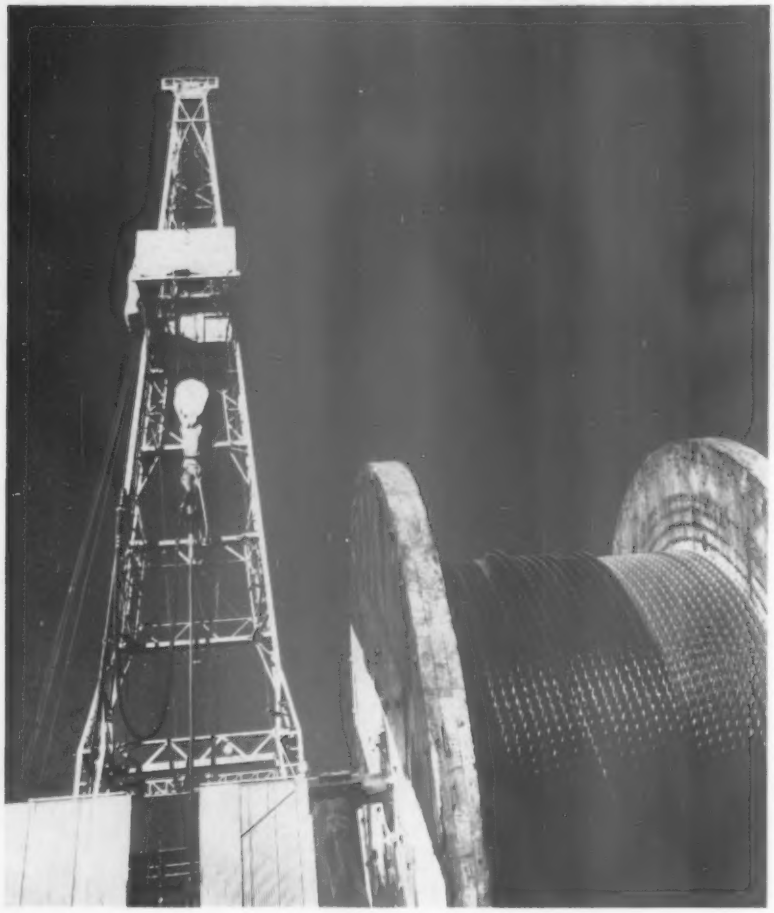

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